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# Electrical World

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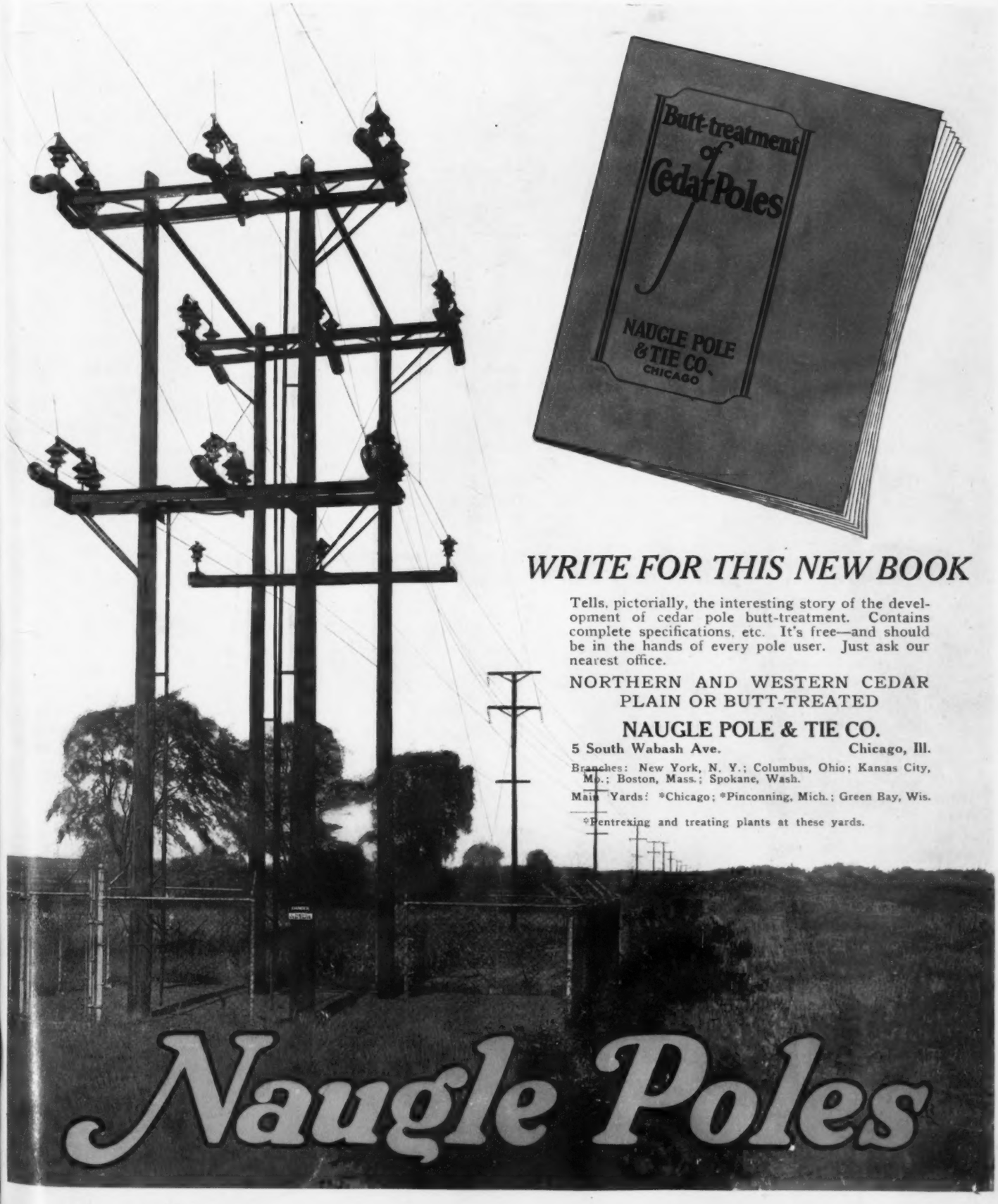


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# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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# *A Mortgage on America*

EIGHT years ago it cost America in the aggregate about 12 per cent to market her goods. The consumer paid about 12 per cent more than the factory selling price, which, of course, was spent for distribution. Today it costs more than 24 per cent. The war has doubled up this overhead expense by charging up more taxes, higher wages and so on.

In a word, we have taken out another mortgage on America and shot the money up into the air. And now we have the mortgage on our hands, and to carry it we are compelled to add an interest charge of 12 per cent on everything we sell. And this is fixed and permanent. It is here for good. The mortgage stands. The interest never slackens.

MEN shut their eyes to facts like these. But it is more than theory—more than statistics, more than economics. It is an issue which is everybody's problem. In short, are we content to carry this double cost for evermore? Or will we save the interest money in some other way?

Out of the city of Cincinnati comes a graphic presentation of the only answer. In this conservative old town, where cheap natural gas has always held back electrical progress, in the last two years they have wired and taken on the central-station lines 25,000 homes. In these homes 25,000 normal, ordinary families have been convinced that now is the time to wire and equip electrically. They have been "sold" in spite of all the clamor of the pessimists who through the entire land are claiming that the times are bad and nothing can be done.

But that is not all that they are doing in Cincinnati. They have figured also that every consumer should be a market for $200 worth of appliances. This means that those who wired last year should buy $3,000,000 worth. And those that they expect to wire this year should buy $4,000,000 worth. And houses previously on the lines should spend $6,000,000 more. So they are going after this $13,000,000 in appliance business in the same way that they sold the wiring.

How have they done it? How will they do it? By adopting methods to conditions, that's all; by meeting hard times with easy terms. And they have proved again that *selling will sell* in any year, in any place, if it is just made possible for people to purchase what they naturally want.

THERE are two ways to carry a mortgage. One is to shoulder the burden and struggle on. The other is to make more money by better work with head and hands and gradually pay it off. They are lifting the war mortgage for electrical men in Cincinnati by facing the facts and tackling the job. It can be done in every other town.

# Thomas Edward Murray

*Who as consulting engineer, utility executive and inventor has greatly contributed to the upbuilding of the industry.*

TO MOST men it is sufficient that they excel even in a single branch of the industry. In Thomas E. Murray, however, we find a consulting engineer and power-plant builder of outstanding prominence, a central-station executive of noteworthy achievement and an inventor whose creative ability has won for him one of the highest American scientific honors. Mr. Murray now gives most of his attention to the business of the consulting engineering firm of Thomas E. Murray, Inc., of which he is president. He is now completing one of the largest and in many ways one of the most exceptional steam plants in the country, namely the new Hell Gate station of the United Electric Light & Power Company of New York City. This plant has initially four 35,000-kw. units and is designed to have an ultimate rating of 280,000 kw. The results to be gained from phase isolation and the unusual method of using condensing water will be watched by the industry with considerable interest. Today there stand as monuments to his engineering skill the well-known Waterside No. 1 and No. 2 stations of the New York Edison Company, the Sherman Creek plant of the United company, steam plants in Albany, Troy, Rochester, Utica and Brooklyn, N. Y.; Dayton, Ohio, and other places, and the hydro-electric development on the Tennessee River at Chattanooga.

Mr. Murray was born at Albany, N. Y., Oct. 21, 1860. At an early age he entered an apprenticeship as a mechanic in Albany. He made rapid progress and his ability became generally recognized, so much so in fact that at the age of twenty-one he became engineer of the city waterworks. It was about six years later that the late Anthony N. Brady launched the Albany Electric Light Company and Mr. Murray was chosen chief engineer, advancing to superintendent and finally general manager. During this period he also acted for a number of years as consulting engineer for the Albany Street Railway Company and the railway and electric lighting properties in Troy.

Thus began another of those famous associations for which the electrical industry is noted. In 1898 Mr. Brady brought Mr. Murray to New York to effect the physical merger of the electric lighting systems in Brooklyn, and shortly afterward Mr. Brady also intrusted to him the task of consolidating the electric lighting properties in Manhattan into the New York Edison Company, of which property Mr. Murray became second vice-president and general manager.

In the midst of these activities Mr. Murray has found time to patent between three and four hundred inventions. More than two hundred of these are electric protective devices for the manufacture of which the Metropolitan Engineering Company was established sixteen years ago. In recognition of his work in this field the Longsworth medal was awarded to Mr. Murray in 1910 by the Franklin Institute, and in 1913 he received the gold medal of the American Museum of Safety. Credit is also due him for the invention of the individual reactance coil and several steam-power-plant devices which include a cinder catcher and a safe and economical container for stored coal. Of late years he has been giving considerable attention to electric welding and has obtained a large number of patents covering his work in this field.

Mr. Murray still retains his official connection with a number of light and power companies. He has found time to engage in electrical society activities and for two years was president of the Association of Edison Illuminating Companies. Among the many honors he has received none perhaps is held by him in higher esteem than the honorary degrees of doctor of science, conferred on him by Villa Nova College, and doctor of laws, by Brooklyn College.

# Editorial Comment

Electrical World, March 18, 1922

Volume 79 Number 11

### A Commission Should Decide the Fate of Muscle Shoals

ONE of the best suggestions which have emanated from Washington thus far with reference to the Muscle Shoals project of the government was made by Congressman Kahn, chairman of the House committee holding hearings on it. He recommends, and no doubt his suggestion will be carefully considered by the committee, that the whole matter be turned over to a commission comprising the Secretaries of the Treasury, War and Agriculture, with power to adjudicate the various claims and to lease, sell or operate the plant as it deems best. So long as the affair dangles before Congress, so long will it be used as a political catspaw, and the Muscle Shoals squabble should not be permitted to clutter up the calendar, especially at a time when the country is looking to Congress for much needed and pressing legislation. Congress has never appropriated one cent for the development of Muscle Shoals as such. Every bill offered with that purpose in view has been defeated on its merits. What now exists at Muscle Shoals was erected by President Wilson as an emergency war measure, and Congress has since refused to appropriate the necessary funds to complete what was started. The drawn-out hearings before the Congressional committee on the various offers made to the War Department have established the fact that much of the work is tied up by contracts which will cast a cloud over any title to the property. The suggestion, therefore, of placing the matter in the hands of the commission is to be commended, as it offers a way to handle the matter expeditiously and equitably.

### The Real Problem of the Ex-Service Man

BEHIND the problem of the soldier bonus is another very vital consideration which may well be thought of while this subject is under such general discussion. What is the chief interest to America in the working out of this complicated heritage of the war? Unquestionably the end to be most desired is that the ex-service man may be physically, mentally, vocationally and financially rehabilitated, so that he may be returned and merged into the citizenry of the country to disappear as a class either political or social. For there is no safe place in a democracy for an ex-soldier class, either claiming or receiving special privilege or exerting influence that does not function as a natural factor in a self-governing community.

The men who formed our armed forces in the war came out of the heart and brawn of America. They *were* America and so they remain—not a class in contention with the American government or American industry on any point, but a great, enduring element in American life and character, honored, beloved and held in grateful memory for their heroic achievements and great sacrifice. Every disabled man and his dependents should be cared for. Health, disability and unemployment insurance should be provided for every veteran. But a cash bonus would neither represent the obligation of the nation nor provide any real measure of relief, for the small sums contemplated would last no time. Moreover, such a bonus would create a precedent for other bonuses that might logically follow, and, worst of all, perpetuate an unnatural ex-soldier class with no proper place in American democracy.

The world has come to be so closely knit and the nation such a unified community that men of science, industry, finance and business are compelled today to fabricate into their thinking influences not only economic but social, political and international as well. These under-aspects of such national questions, therefore, cannot be left to Washington alone. The strength of America rests in the minds of the people and the responsibility with the leaders of our thought.

### The Inalienable Right of the State to Fix Rates

VIEWED from any angle, the decision of the United States Supreme Court handed down last week in the Consolidated Gas case is most interesting. For the edification of those for whom truth and fact are not necessarily established unless they are constantly reiterated or confirmed, the highest court again asserts that "rate making is no function of the courts and should not be attempted either directly or indirectly." We question whether any public service commission ever had any doubts on that matter, but inasmuch as the civic authorities of New York felt otherwise it is well to have the law reiterated. It is refreshing also to public utilities to have the highest court settle without quibble or qualification the right of a public utility to a rate for service which is not confiscatory. "Mere past success," the court says, "could not support a demand that it continue to operate indefinitely at a loss. The public has no such right in respect of private property although dedicated to public use. When it became clear that the prescribed rate had yielded no fair return for more than a year and that this condition would almost certainly continue for many months, the company was clearly entitled to relief."

Two well-merited rebukes were administered by the court—one to the Public Service Commission, which, possessing the power to fix rates, was too slow in asserting itself, and the other to the lawyers for the appellant, who, contrary to the rules of the court, presumed on its indulgence by dragging in 20,000 printed pages of evidence and thereby came preciously near having the case thrown out of court. Many clients feel that the fees paid to a lawyer bear some ratio to his loquacity, but the "gift of gab" is not always to be commended. Pope years ago said: "Words are like leaves, and where they most abound much fruit of sense beneath is rarely found." Very much the same senti-

ment was expressed by the Supreme Court, the learned judge who delivered the opinion saying that "the master talked too much and often unwisely." The same strictures might apply to many valuation experts. Real estate experts have no difficulty in determining very quickly the value of property, and it hardly seems unreasonable to expect that public utility property may some day be valued just as expeditiously and inexpensively for rate-making purposes.

## Electric Smelting as a Means of Utilizing Low-Grade Iron Ore

ALTHOUGH the threatened exhaustion of high-grade native iron ore is not likely to occur in the next quarter of a century, as has been prophesied by some statisticians, it has nevertheless focused interest upon the possibilities of electric smelting of low-grade deposits as a solution of an American industrial problem that may become serious. Already twenty-seven large installations, with a total electrical equipment of 100,000 kw., are in operation or under construction in various parts of the world.

Unfortunately there may have been many failures in the effort to smelt low-grade ores electrically, but it appears that these failures have frequently been due to lack of expert metallurgical advice, the promotion of so-called "direct" and "secret" processes having misled investors. Sound technical advice appears imperatively necessary in the development and commercial exploitation of electric smelting of iron and the production of steel by the electric furnace. There is little doubt that by electric smelting iron ore superior in quality to that made in the ordinary blast furnace can be produced with marked savings in time per heat in steel production.

However, very careful studies of costs must be made before undertaking commercial work in the low-grade ore field.

## One Interest of the Utility in the Railway Problem

TRANSPORTATION being a vital element in every business nowadays, the condition of the railways is a matter of particular concern to the electrical industry and of interest to each individual. Secretary Hoover's analysis of the existing situation as published in this issue merits some careful thought. One phase of it is especially pertinent to the public utility.

At the present time the railways of this country are behind in rolling stock by about 4,000 locomotives and 200,000 cars. Since 1917 they have laid down in trackage 10,000 miles less than our increasing population and economic development call for. Because of the existing industrial depression this equipment is carrying the load, but the time is clearly not far off when growing business will begin to place an overburden of demand upon the railways. Then when the peak of a crop movement is superimposed there will result a car shortage so stringent that industry and the public will pay a toll far heavier in added cost on coal and general commodities than would have provided the rolling stock and rails that then will be so badly needed. Such a transportation crisis will inevitably produce a storm of popular protest and a renewed unreasoning demand for government operation that in every direction will reflect new feeling on the whole broad subject of municipal, state and federal management of utilities.

In years gone by a great reserve capacity in rolling stock has been provided by the larger railway systems. Between crop periods these cars have waited on the sidings, carried against the coming season of maximum demand, when they have been thrown into the service of all lesser roads and all the people. But under the conditions of today the larger roads no longer can afford to finance and maintain this car and motive power reserve as a contribution to the seasonal needs of industry. And this question comes to mind: With rates and wages regulated by the government, can the few great roads longer be required or permitted to maintain this seasonal equipment? Or should the government, as a feature of its regulation, in the interest of the people, provide for the excess peak-load rolling stock made necessary by our present system of unbalanced transportation burden? It is a problem not for the railroads alone, but for all who are involved in the broader issue of protecting the national investment in utility properties and guiding the education of the people in this new responsibility which has come to them with the expanding growth and value of regulated utilities.

## Debt to Pure Scientists Should Be Recognized

THE astonishingly rapid and extensive expansion of the field of electrical engineering is probably due in largest measure to the wide, and in fact almost universal, prevalence of electrical laws and processes in fundamental natural phenomena. The relations of electricity and magnetism with the underlying problems of physical science have been uncovered by physicists and other workers in the field of pure science in their constant attack upon the great problem of the ultimate nature of matter and the laws which control it. The names of Cavendish, Ampère, Faraday, Maxwell and Thompson spring first to mind, but the list may be extended to great length. The laws upon which all the applications of electricity in the modern field of engineering depend may be traced directly to the discoveries of these great investigators and their successors. Moreover, within the brief space of a hundred years or so the attraction and promise of exploration in this field has become so great as now to number its workers probably by thousands.

Hand in hand with discovery in the field of pure electrical science goes the expansion of the field of application of the laws uncovered. It is this fact more than any other which lends its charm and fascination to the profession of electrical engineering. Immediately back of the workaday problems of design and execution there is always open to the inquiring electrical engineer, as a resource replete with interest and promise, a field of experimental study, investigation and speculation.

As a consequence the debt of the electrical engineer to the pure scientist should always be appropriately recognized. We are in the habit of offering this recognition in some of the most notable instances. Last year, for example, the centenary of Oersted's discovery of the magnetic effect upon electrical currents was not only celebrated in his native country but electrical engineering societies throughout the world also took appropriate notice. We shall doubtless have even a greater celebration on the hundredth anniversary of the work of Faraday and Henry leading to the discovery of electromagnetic induction. Our debt, however, is so great that we should look even beyond these great outstanding dis-

coveries for others which have also contributed to the foundations of the present great structure of applied electrical science and render due praise and homage whenever a date marking the original discovery of some great contribution is passed.

These thoughts are suggested by the twenty-fifth anniversary of a discovery which immediately antedates that of our youngest agent of such great promise, the electron, and which was so intimately related to it as almost to warrant its being considered a part of the discovery of the electron itself. In 1896 Zeeman discovered the influence of a magnetic field on a source of light, separating the lines of a spectrum and showing beyond doubt the presence and motion of electric particles smaller than the atom within the substance of the source. Faraday had already suggested the relation between light and magnetism by his discovery of the rotation of the plane of polarization by magnetic field, and it remained for J. J. Thomson to isolate the electron. It is well to bear in mind, however, that Zeeman's discovery, in addition to its creation of the modern field of magneto-optics, also stands out as an important link in the progress of investigation which has given us today the electron tube and its expanding field of usefulness.

## Current Distribution in Busbars Becoming Serious Problem

UNTIL recently skin effect has rarely assumed serious proportions in the range of commercial power frequencies. However, with the increase in the capacities of modern plants, their feeders and distributing circuits, and with the reversion to 60 cycles, the reduced carrying capacity of large conductors due to the skin effect has become of serious moment.

Even in the simplest of all cases, that of a solid conductor of circular cross-section, the exact theoretical analysis is extremely involved. With conductors of cross-section other than circular, and with stranded cables of the usual type, it is quite impossible. The theoretical studies of all cases of skin effect therefore are usually approximations based on assumptions of symmetry known to be at variance with the actual conditions. As a consequence present knowledge of the magnitude of the skin effect is based rather on experimental observation, each new type of case being attacked as it arises. Within the past year several interesting papers in this field have appeared. In the article by C. F. Wagner in this issue another closely related problem is studied, that of the unequal distribution of current among the several parallel connected conductors of large station busbars. In this case, owing to the large total cross-section and the space separation of the several conductors, the inequalities are especially marked. In one common type the current density at the center of an inner bar was shown to be only 29 per cent of that near the edge, and its phase 129 deg., lagging. The simple but ingenious method of experiment used also brings out other interesting results. Aside from the inefficient use of conducting material, the distortion of current density is also objectionable as leading to local high temperatures.

Corrective measures consist in transposition and special forms of grouping, and for best results in the use of special reactances inserted in the outer conductors for shifting the current to the idle ones inside. The serious magnitude of the effect is indicated by the introduction of this added complication and expense.

## A Machine Rating Should Express a Definite Limitation

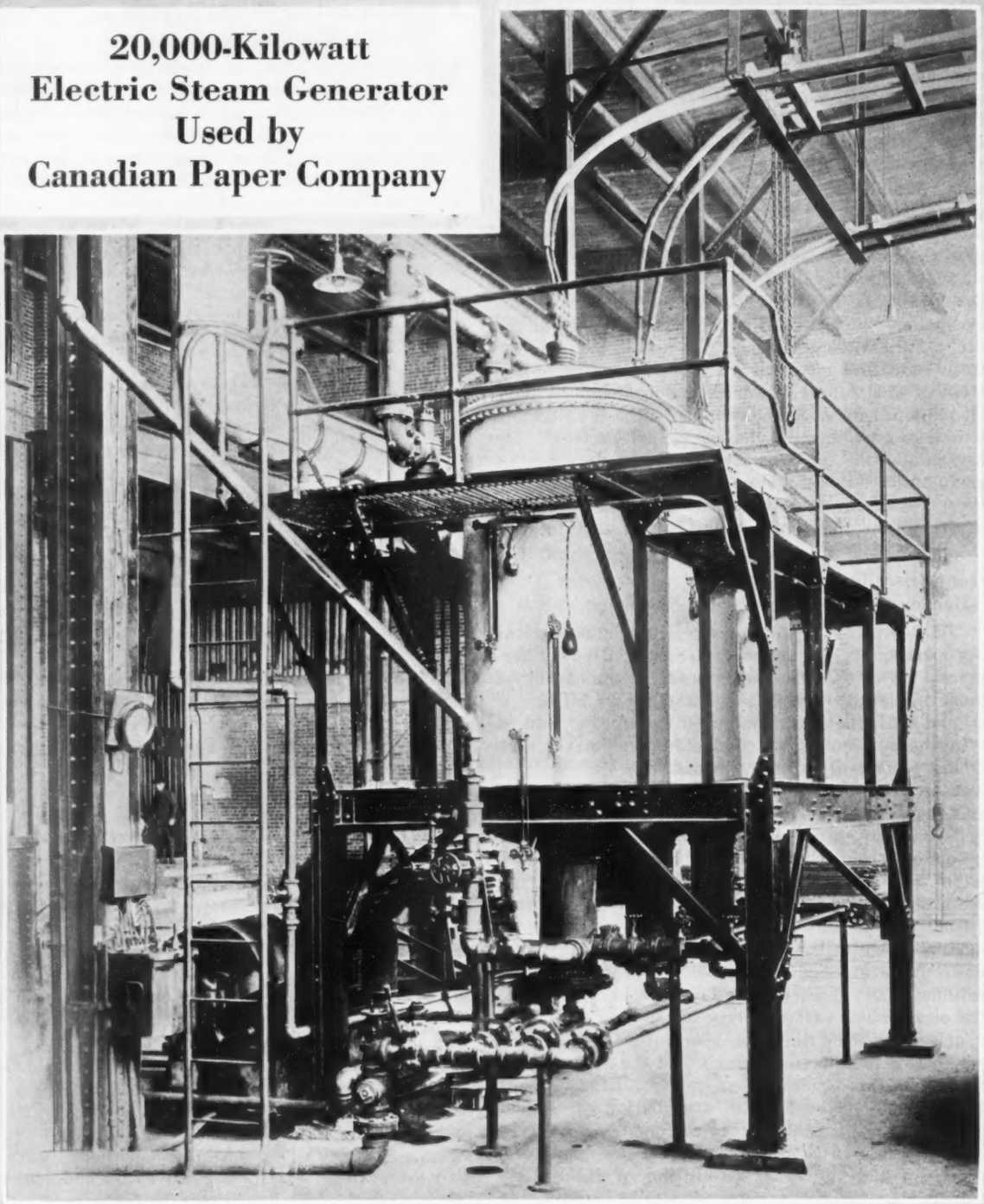
MOST of the advances in electrical design and construction which have been made by the slow process of standardization have encountered considerable opposition. Usually these advances have been put into effect by extremely small majorities. It is, therefore, not to be wondered at that the conception of a single rating of electric generators and motors has found many manufacturers and users strongly opposed to this modification. It is proper that due and careful consideration should be accorded to such opposition and that any possible argument that may be advanced against the use of the single rating should be considered thoughtfully in all possible aspects before its final rejection.

When the industry was in its early state of development and when the properties of insulating materials were hardly known or considered, when the designer groped in the dark as to the outcome of his designs, and when, last but not least, the amount of power required by machine tools or other appliances to be operated by electric motors was almost totally unknown, it appeared logical to place a rating on the machine which gave only a general idea of its capacity. This gave considerable latitude to the engineer who wished to apply it, so that if he made an error of 100 per cent in his calculations the machine was still able to do the work for which it was intended.

In the first place, a liberal estimate had to be made of the power required and, secondly, a motor was applied which was ample for its rating. These two allowances added together constituted a very large overestimate of the size of machine to be installed. With increased experience and judgment, with an increased understanding of the power required by the machines to be operated, it became essential to know the real, reasonable limit of capacity of a motor or generator; and now most engineers prefer to make their own allowances, knowing definitely what the electric machine is capable of doing, rather than to have the manufacturer's allowance added to their own, thus piling one margin of safety upon another. It would appear, therefore, that the rating of a machine should express the limit of its capacity, instead of an arbitrarily chosen designation of an equally arbitrarily chosen capacity.

The older conception in putting a rating of 40 degrees on an electric motor was to select arbitrarily one of the many ratings which could be put upon the machine, instead of giving the reasonable limit at which the machine could function indefinitely without injury. The 50-degree rating, which has received the indorsement of the Electric Power Club and is being favored by many engineers in this country and abroad, is a more definite conception of the limitation of the machine than the earlier rating of 40 degrees. For the same reasons that a standard of length is a given quantity and that a foot rule is meant to measure lengths within one foot and is not intended to be stretched, the ratings of electrical machines should not be stretched beyond the limits on which the rating is based. Any true conception of a "rating" must express a definite limitation. The most serious effect of a double rating for electrical machines is the obliteration of all conceptions of genuine standardization and the subordination of principles of accurate measurement to considerations of commercial expediency.

# 20,000-Kilowatt Electric Steam Generator Used by Canadian Paper Company



FOR nearly six months the Belgo-Canadian Pulp & Paper Company has been producing its process steam with a 20,000-kw. electric steam generator. Sixty thousand pounds of water are being evaporated per hour with a thermal efficiency of 98 per cent, including losses in 100 ft. of piping. According to reports, engineers of the paper company have estimated a saving of $4,000 per month with the new system, which saves 75 tons of coal a day. Installation costs—about $25,000—were 40 per cent less than the cost of the coal-burning plant replaced.

Three-phase, 6,600-volt power from the Shawinigan Water & Power Company, Montreal, is utilized directly in the tanks shown above, the resistance of the water converting the electric energy into heat for generating the steam. The amount of steam generated, the pressure and the amount of power used are governed by the depth of immersion of the electrodes in the tanks. The design was developed by F. T. Kaelin, chief engineer of the power company.

Already generators of this type with a total rating of 100,000 kw. have been installed or contracted for, according to F. Hodson, president of the Electric Furnace Construction Company, Philadelphia. He declares that the most important applications of the electric steam generators will probably be in industries situated within convenient transmission range of hydro-electric plants. Where savings in initial cost, space occupied and operating expense are very important, the electric steam generator will have many points in its favor.

# Local Selling of Holding Company Stock

## Organization of Securities Department and an Employees' Club to Promote Stock Sales—Preparation of Prospect Lists—Advertising and Selling Methods—Maintenance of Market for Resale of Stock

By H. E. WEEKS
*General Manager Securities Department, United Light & Railways Company, Davenport, Iowa*

IN A LITTLE less than a year the United Light & Railways Company, through employees, sold more than $1,000,000 of its 7 per cent prior preferred stock to 3,733 subscribers in the seventeen different communities served by its subsidiary companies. This stock was that of the holding company, not local company stock, and the method used for gaining confidence of prospective stockholders through the organization of an employees' club is interesting and unusual.

The United Light & Railways Company operates seventeen companies, eleven of which serve communities in Iowa, six serving communities in Illinois, Indiana, Michigan and Tennessee. Altogether 600,000 people are served in ninety-one cities and towns.

The stock was first offered on attractive terms to the employees of the company in Iowa and Illinois on Oct. 1, 1920. The response to the offer was very gratifying. Three of our companies subscribed 100 per cent, every employee taking stock; six companies showed percentages ranging from 91.5 per cent to 99.2 per cent; one street-railway company took 82 per cent. The employees of several companies have not yet had the opportunity to subscribe. The stock was then offered to the public through employees of the company only for cash at par or on the installment plan with a payment down of $10 and installments of $7.50 per month plus interest on the unpaid balance.

### TEAM ORGANIZATION

The employees of each of the large companies were then separately organized into teams of ten members to compete in the sale of the stock, and the cities were divided into districts to be assigned to the teams. Our first method was to select as many captains as we expected to have teams, allowing the captains to choose in rotation from a list of workers until they had filled their teams. This, however, was found to be a mistake as team workers were chosen who lived in different sections of the city, whereas by our plan a team was assigned to a certain district. The teams were, therefore, reorganized so that the members lived either in or adjacent to the district assigned to their team. This enabled an employee to work in the vicinity of his home, which on account of the limited time in the evening available for the work was important.

Schools of instruction were conducted for employees who had volunteered to sell the stock to familiarize them with stock selling, sales policies, organization and sales methods. The campaign for sales was then launched. Each salesman was furnished with a salesman's manual containing convenient answers for commonly asked questions. Competition was encouraged by special prizes. A special campaign was conducted for a few weeks to offset an attack on the company by the socialist administration in Davenport. The employees engaged in stock selling were released from their regular duties for one week to concentrate on stock sales. The results demonstrated the fact that it is often possible to convert a "knocker" into a "booster" by making him a stockholder.

After the team organizations had been maintained for about three months it was decided to organize a separate department of the company, to be known as the securities department, to which was given full charge of the sale of securities. The manager of each operating company was made responsible to the manager of the securities department for the sales by his company. Employees who had made the best records as salesmen were selected and put in the securities department.

### "UNITED GO-GETTERS' CLUB"

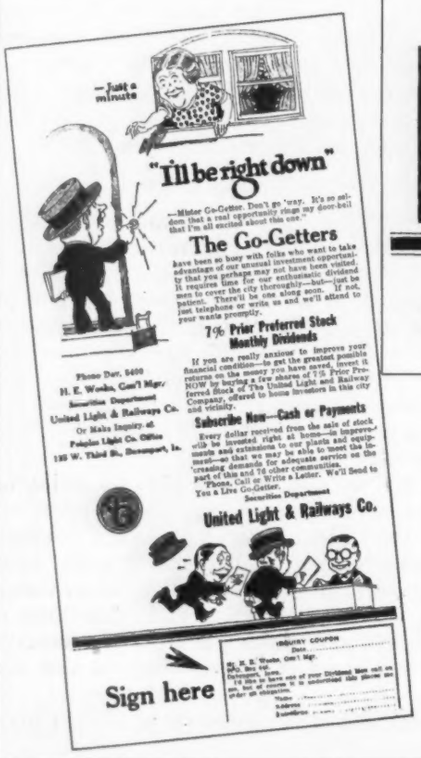
Approximately $500,000 of stock was sold in the manner outlined between the inauguration of the sale and Oct. 25, 1921, when a special campaign was put on to sell $500,000 of stock in six weeks. To co-ordinate the work and put on this sale the "United Go-Getters' Club" was formed. A local section of this club was organized in each company operating in Iowa and Illinois. It was the idea of the officers of the company in organizing this club to make it a permanent institution, and the articles of association provide:

"It shall be the purpose of this club to unite for service all its members in order to further their own and the interests of the United Light & Railways Company in every honorable manner, and whenever called upon, to do all in their power to promote, assist and encourage every legitimate enterprise, whether civic, charitable or otherwise, which will add to the welfare and prosperity of the communities in which the members of this club are residents."

The club is composed of the directors of United Light

# Advertising that Sold Utility Securities

## Typical Publicity Used in United Light & Railway Company's Stock Campaign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Securities Department
United Light & Railways Co.
Sign here
INQUIRY COUPON

One of them will call on YOU!

Here they are! The Go-Getters—the Dividend Men! A regiment of them! Every one of them enthusiastic and eager to start their work!

Today—and every day for six weeks—these Go-Getters will scatter about the city carrying a vital message to some one—eventually, we hope, to every man, woman and child.

A Go-Getter has no doubt been delegated to call on you! If not, you're going to be the loser!

Watch out for him when he calls. Listen attentively to the message he brings to you, for it has an important bearing on your future welfare.

**To show you the road to prosperity**

Who are these Go-Getters—these Dividend Men? They are community boosters—Men with a Punch—Men full of Pep because they're on the way to show you the road to prosperity.

The Go-Getters are enthusiastic employe-salesmen of the United Light & Railways Company—each man personally a shareholder in the Company, and every man willing to devote the time necessary to show YOU how to participate in the continued growth of this city—how to share in the earnings of one of the best utility companies in the country—a Company supplying day in and day out services that are indispensable to the very existence of the people in this and 76 other cities and towns.

You want a dividend check every month? Of course, you do! You wouldn't be human if you didn't! Then listen to the Go-Getter when he calls. Do exactly as he tells you—and you won't regret it.

Phone Dav. 5400
H. E. Weeks, Gen'l Mgr.
Securities Department

**United Light & Railways Company**

Or Make Inquiry at

People's Light Co. Office — 125 W. Third St. Davenport, Iowa

It makes no difference who you are nor how you are situated, financially or otherwise—

Nothing that you do can help you better Than that little message from some Go-Getter!

Call the Dividend Man if he doesn't call you.

Sign here

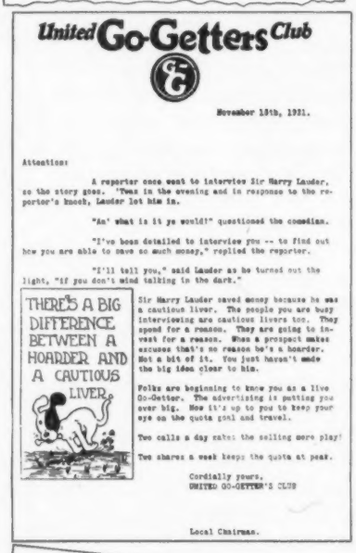
Inquiry Coupon

Mr. H. E. Weeks, Gen'l Mgr.
P. O. Box 446
Davenport, Iowa.

I'd like to have one of your Dividend Men call on me, but of course it is understood this places me under no obligation.

Name .....
Address .....
Telephone .....

"You can buy those, lady, with the dividends you'll get every month"
Do It Today!
PHONE DAV. 5400
H. E. Weeks, Gen'l Mgr.
SECURITIES DEPARTMENT
UNITED LIGHT & RAILWAYS CO.


United Go-Getters Club
November 18th, 1921.
Attention:
A reporter once went to interview Sir Harry Lauder, so the story goes. 'Twas in the evening and in response to the reporter's knock, Lauder let him in.
"An' what is it ye would?" questioned the comedian.
"I've been detailed to interview you -- to find out how you are able to save so much money," replied the reporter.
"I'll tell you," said Lauder as he turned out the light, "if you don't mind talking in the dark."
THERE'S A BIG DIFFERENCE BETWEEN A HOARDER AND A CAUTIOUS LIVER.
Sir Harry Lauder saved money because he was a cautious liver. The people you are busy interviewing are cautious livers too. They spend for a reason. They are going to invest for a reason. When a prospect makes excuses that's no reason he's a hoarder. Not a bit of it. You just haven't made the big idea clear to him.
Folks are beginning to know you as a live Go-Getter. The advertising is putting you over big. How it's up to you to keep your eye on the quota goal and travel.
Two calls a day nets the selling more play!
Two shares a week keeps the quota at peak.
Cordially yours,
UNITED GO-GETTER'S CLUB
Local Chairman.

"As you sow - so shall you reap"
Our Dividend Men
Phone Dav. 5400
H. E. Weeks, Gen'l Mgr.
SECURITIES DEPARTMENT
UNITED LIGHT & RAILWAYS CO.
Or Make Inquiry at
PEOPLES LIGHT CO. OFFICE
125 W. Third St., Davenport, Iowa
Sign here
INQUIRY COUPON

THESE newspaper advertisements were prepared especially with the view to getting away from the conventional appearance of the usual financial announcement and the results of the campaign have demonstrated the value of this policy. One of the Go-Getters' Club "pep" letters is also reproduced, showing how employees' interest in stock selling was maintained.

& Railways Company and its subsidiary companies, the managers of properties, the officials of the securities department and such employees as had shown especial interest in the previous distribution of stock.

### BONUS AND PRIZE OFFERS FOR STOCK SALES

Prizes aggregating $5,000 were offered, their distribution being contingent on the quota for the campaign being sold. A book of instructions to salesmen was printed, explaining these special prizes, together with a bonus for keeping up the quotas during the campaign, which was awarded on the following basis:

If a member sold his quota the first week and again the second week, he received a bonus of 10 cents per share on his total sales for the two weeks. If a member sold his quota during the third week, he received a bonus of 20 cents per share on his total sales for the three weeks and so on during the six weeks campaign. In other words, if a member made his quota for the six weeks of the campaign, he received a bonus of 50 cents per share on all stock sold by him during the period of the campaign.

In addition to the prizes which were annouced in the book of instructions, when the campaign was put over a special prize of $50 was given to six "Go-Getters" who had sold fifty shares or more of stock and were the second highest men in their locals. A special prize of $75 was also given to the "Go-Getter" who sold to the largest number of public subscribers, and the locals which exceeded their quota by more than 5 per cent were allowed $1.50 for each member, to be used in defraying the expense of a dinner to celebrate the success of the campaign.

### OBTAINING PROSPECT LISTS

We endeavored to profit by our experience, which indicated clearly that the success of the sale would be dependent largely on the number of good "prospects" called upon. We arranged to have each manager appoint a committee consisting of the employees having the broadest acquaintance among the customers of the company to eliminate from the customers' list the names of those who in their opinion would not make good prospects. Out of the total customers' list of approximately 70,000 names, 32,000 prospect cards were made up. Our slogan for the campaign was, "Call on two people each day—sell at least two shares each week." With 460 active members in the "Go-Getters' Club," we figured that this would enable us to cover the prospect list of 32,000 names during the period of the campaign. Judging from our previous experience, we felt sure that we could sell to a minimum of one in eighteen of those canvassed, especially in view of the improved financial conditions on some of our properties and the fact that we had decided to accept Liberty bonds in payment for the stock, beginning with the opening of the campaign.

When planning for the campaign it was decided to employ the McJunkin Advertising Company of Chicago, which had done splendid publicity work for us when the sale of stock was first inaugurated. This company prepared for us a special series of advertisements different from any financial advertising we had previously seen. It also prepared a series of "pep" letters to be sent out weekly to the members of the "Go-Getters' Club." We thus had the benefit of the McJunkin company's experience in serving other public utilities.

The campaign was opened with a dinner at the Blackhawk Hotel in Davenport, at which there were present about 100 "Go-Getters" from the properties outside of the Tri-Cities and about 300 "Go-Getters" from the Tri-Cities. Frank T. Hulswit, the president of the United Light & Railways Company, explained in an address the objectives of the campaign.

In the second week of the campaign it was decided that an inspirational talk by some one experienced in salesmanship would be beneficial, and the services of a former instructor in salesmanship at Northwestern University, a man of wide experience, were engaged. He gave ten lectures to the "Go-Getters" at the different properties in Iowa and Illinois.

Too much credit cannot be given to the influence of the publicity of which we made use. Our situation was a particularly trying one owing to the fact that prior to the inauguration of the sale of stock no publicity whatever had been given to the United Light & Railways Company. In fact, it had been the policy to play up the local management of the subsidiary companies and avoid mentioning the name of the holding company. Wide publicity in the form of newspaper advertising, folders, stickers on bills, street-car display cards and personal letters was therefore necessary to pave the way for the salesmen.

### MAINTAINING MARKET FOR THE STOCK

The maintenance of a market for securities sold only by the company is of greatest importance. A large proportion of the investors are of the savings-bank type, and unless the integrity of their investment is protected it cannot be expected that they will recommend the securities to their friends. If the stock is sold to them at par and they find they can get par in return, less a small commission for reselling, it will dispel their desire to sell.

We are selling a 7 per cent preferred stock at par only through our employees and special salesmen, who are instructed to inform the public that the stock will be sold in no other manner and that we expect to be able to maintain the market for the stock at par because of the fact that all stock will be offered to us for resale. We insist, however, that our salesmen inform people that we do not guarantee to resell the stock at par. Up to the present we have been able to resell all the stock that has been offered, which so far has amounted to only about 7 per cent of the total stock sold.

Before starting the sale in each community we interviewed the local bankers and informed them of what we intended to do. In many instances we have had their active co-operation, and in no case have we discovered that they were criticising our plan. Under the existing conditions we could not expect them to be enthusiastic about having the money taken out of their banks, and we have given our salesmen to understand that they will not encourage depositors to withdraw their money.

### VALUE OF PUBLICITY

The effects of our publicity were clearly apparent in the reception which the members of the "Go-Getters' Club" received when they made their calls. When we first began to sell the stock many cases were reported where people had refused even to talk to the salesmen, but very few cases of this sort were reported during the campaign.

Prior to the opening of the campaign we had sold to 1,958 subscribers in ten months. During the period of the six weeks intensive campaign we sold to 1,775 subscribers more than $500,000 of stock. We have placed over $1,000,000 of the stock with 3,733 subscribers in

approximately one year's time, an average holding of less than three shares per stockholder.

We have discouraged from investment in our stock those who expected to make use of their money in the near future for the purchase of a home or for other purposes and have explained to them that we wanted only permanent investors.

We have found that it was necessary in many cases to call frequently on a single "prospect" before closing the sale, and very often fifteen or twenty calls might be made on different persons before a sale was made. The class of investors is such that a great many of them can only be seen at night, when the employee must sacrifice his leisure time to see them. Our experience, and I believe it is approximately borne out by the experience of others, is that the average original sale is three shares.

It is difficult to estimate the value to the company of the better knowledge of its affairs gained by the employee who becomes a stockholder and salesman. This is true in like manner of the customer who becomes a stockholder.

Finally, too much emphasis cannot be placed on the fact that some companies in promoting customer ownership have overlooked the importance of protecting the customer in his investment and will pay many times over in the ill will toward them which has thus been created. Great care has to be exercised to prevent employees from using "high-pressure" methods and making promises which the company cannot keep. In their eagerness to sell they sometimes lose sight of the fact that the company does not want short-time depositors but investors who will be permanent, and that a permanent, satisfied customer-stockholder, even though he be a subscriber for only one share, is a valuable asset to the company.

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# The Economic Function of the Railroads*

### Importance of Keeping Utilities Financially Strong and Unhampered by Public Prejudice or Governmental Bias — Private Initiative Is Essential

BY HERBERT HOOVER
Secretary of Commerce

IT MIGHT be profitable for our people to get a somewhat clearer perspective of our own and the world's troubles and problems. Even a superficial survey must bring us out of an atmosphere of gloomy introspection into an assuring realization that, great as our dislocations may seem to be, we relatively are in an enviable position. Our nation is unshaken and as a people we are getting our bearings in a world of perplexing economic adjustments. While there is unemployment and lack of profit taking, we are free of panic. We are comparatively more restless than injured.

The violence of our readjustment, however, is without parallel, and we sometimes tend to color our measures for the future by the depression we are in. The fact is that we must predicate all plans for the future on the ultimate return of the American people to a normal economic activity, with our annual progress in the expansion of our production, of our plant and equipment, of our skill and our efficiency. There can be no question that this return will take place, and no responsible body will approach our problems on any other basis. Not one of us would submit to the charge that we were not prepared to bet against any odds upon the future of the United States. Our problem is to expedite this recovery—to speed up employment of our workers, and thereby find a market for our farmers.

If we look at the national economic situation as a whole, the greatest impulse that can be given to recovery from any source whatever would be a reduction of rates on primary commodities combined with the immediate resumption of railway construction and equipment. The first depends upon reduction of operating costs, the second upon restoration of credit for our railways.

One thing is absolute. Our transportation facilities are below the needs of our country, and unless we have a quick resumption of construction, the whole community—agricultural, commercial and industrial—will be gasping from a strangulation caused by insufficient transportation the moment that our business activities are resumed.

Few people seem to realize the amount of expansion in our transportation machine necessary to keep pace with the growth of the country, and equally few seem to have any notion of the price we pay for not having it. Since we entered the war in 1917 we have constructed at least 10,000 miles of railways less than our increasing population and economic development called for, and we are behind in rolling stock by about 4,000 locomotives and 200,000 cars. I wish to emphasize that unless we can have an immediate resumption of construction and equipment our commercial community will pay treble the cost of the whole of them in their losses of a single season. There would be no difficulty whatever, basing such losses on the experiences we have already had, in calculating a loss to the American people of a billion dollars for each one of these periodic transportation shortages.

#### IMPORTANCE OF RESUMPTION OF RAILROAD ACTIVITY

Furthermore, there is nothing that is so irrecoverable a loss to the nation as idle shops and idle men. Today we have both. There is nothing that will so quickly start the springs of business and employment as an immediate resumption of construction and equipment of the railways. If we examine the fundamental reasons for failure to resume equipment we will find them in the loss of confidence in railways as an investment and the competition of tax-free securities. We have passed the period of credit strain in this depression. Surplus capital is pouring by hundreds of millions monthly into tax-free securities and foreign loans, and yet our railways are unable to finance the most moderate of construction programs. The confidence of the public in railway investments was at so low an ebb before the

*Abstract from statement by the Secretary of Commerce before the Interstate Commerce Commission.

war that finance by the issue of common and preferred stocks had become impossible and railway expansion was living on bond issues. The confidence of an assurance and continuity in earning power to cover this burden of bonds has been even lowered since the war began, because of the uncertainties of both rising and falling prices, of rising and falling wages, of rising and falling rates preventing all regularity of earnings upon which an investor could be convinced, even if no other difficult factors entered into the problem. I see no occasion to go into the labyrinth of past railway finance, its propriety or lack of propriety, its foolishness or its skill. That generation is gone by. This commission approaches the financial problems of the railways upon their actual value, not upon their issues of securities, and I take it we are living for the future, not the past. We want transportation, and we want it with the values of private initiative and clean public service.

In these circumstances it seems to me vital that the railways as our greatest industry should propose a courageous program of broad-visioned betterments, and if necessary the government should consider giving the use of its superior credit. It would not cost the taxpayer a cent to give the government guarantee to equipment trusts upon the primary responsibility of the railways, the proceeds to be devoted entirely to improvement and equipment. This is no proposal to take money from the taxpayer. It is a proposal to save him from paying treble the amount of his guarantee in profiteering and losses. It will bring a reduction of rates earlier, for unless something is done the improvements will have to be paid over years out of increased rates. Nor would we lose a cent upon the guarantee, for if American railways cannot earn interest upon their borrowings let us throw up our hands and prepare for a second Russia.

We talk glibly of giving billions of credits to foreign countries to increase our farm exports. I wish to say, with all responsibility for the statement, that a billion dollars spent upon American railways will give more employment to our people, more advance to our industry, more assistance to our farmers, than twice that sum expended outside the frontiers of the United States—and there will be greater security for the investor.

Finally, I want to refer to the veritable witches' caldron being fed constantly with hates distilled from the misdeeds of railway promoters in the past, from the conflicts between the railways and the farmers, between the railways and their workmen. Because of all the confusion that arises we destroy our railways and destroy ourselves. With this commission on one hand assuring honesty in finance, justice to the shipper and the railway investor, with the Railway Labor Board assuring justice to workers, and, above all, with a great spirit of public service in our generation of railway managers, it is time to call off the witches and take some vision of our national situation if we are to pull ourselves out of this depression.

If we survey the results of the past year in the application of present costs and rates, we find many railways failing to earn interest upon their borrowed capital. We find some others, more fortunately situated, which have earned dividends on their share capital. In one or two exceptional cases of low bonded indebtedness railways did extraordinarily well on their share capital. If we survey the situation by districts, in order that single instances shall not mislead us, we shall find that the whole of the Class 1, Southern roads, barely covered bond interest, while the most fortunate group, the Western roads, show an earning of only 4 per cent in 1921 upon their tentative valuation. Moreover, it is obvious that maintenance has been held to a low level and that new equipment and extensions have been practically nil.

The present earnings, in their perilous closeness to bond obligations, seem to me to dispose of the question of immediate important rate relief, if we do not wish widespread receiverships and shocks to our whole commercial fabric.

A great deal has been said about the inefficiency of our railway system. I do not sympathize with these statements. Comparison with foreign railways of the fundamental criteria of per-ton-mile costs, train loading and so forth, in the light of our cost of living, will demonstrate that our railways are of higher standards, better in methods than others, and are growing in efficiency. The consolidation of our railways into larger systems has been contemplated in our legislatures for some years past as a gain in efficiency. Its value can be overestimated—it is not a remedy for all trouble. It does give hope, however, of economies in further efficiency from more complete utilization of rolling stocks and terminals, some small degree of saving in overhead, saving in current inventories; but probably its greatest saving would be decreased cost of proper finance, increased financial stability and fuller independence of the supply companies.

It is probably unnecessary to refer to the question of government ownership. No one with a week's observation of government railways abroad, or with government operation of industry in the United States, will contend that our railways could ever be operated as intelligently or as efficiently by the government as through the initiative of private individuals. Moreover, the welfare of their multitude of workers will be far worse under government operation.

We are struggling with the great problem of maintaining public control of monopoly, at the same time maintaining the initiative of private enterprise. I believe that we are steadily progressing to a solution.

Great social and economic problems find their solution slowly and by a process of trial and error. We have tried unregulated monopoly and have tried government operation, and found the error in them. We still have much to solve if we are to maintain our transportation. Much of this solution depends upon the successful initiative of the railways themselves, and much of the shaping of these matters lies fortunately in your able hands.

ALTHOUGH the statement of Mr. Hoover before the Interstate Commerce Commission dealt entirely with the steam-railroad situation, it applies with equal force to every public utility in the country. The railroads are not alone in their dilemma. Other utilities have had to face financial woes as well, and the regulating authorities have been just as slow and just as remiss as the Interstate Commerce Commission in granting prompt relief. That the investing public has not taken kindly to the bonds and stocks of public utilities is as much a reflection on the commissions as it is an evidence of the short-sightedness of the public. A starved utility cannot function efficiently any more than a starved man, and it is the public that reaps the whirlwind eventually. Mr. Hoover has given a great deal of time and attention to the subject of transportation, and testimony from such a high source deserves careful study and consideration.

# Current Distribution in Multi-Conductor Single-Phase Buses

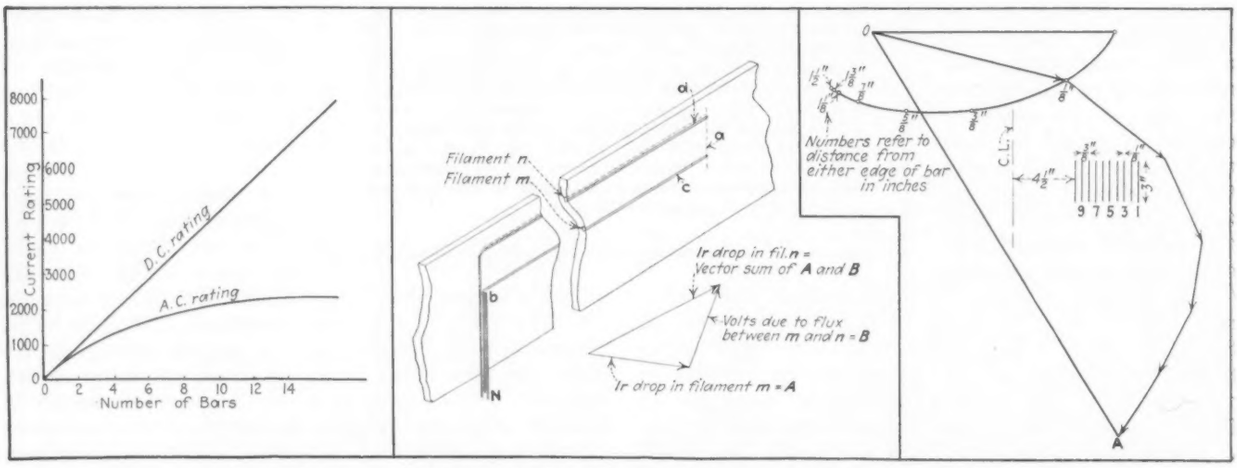
## Study of the Phenomena Involved Is Necessary to Design Busbars for Generating and Distribution Systems of Large Capacity if Cost of Construction Is to Be Minimized—Simple Graphical Method Is Presented

By C. F. WAGNER
*Material and Process Engineering Department,*
*Westinghouse Electric & Manufacturing Company*

GENERATING and distributing systems are increasing in size so rapidly that it is becoming more and more important to determine methods of increasing bus capacity and reducing the cost of construction. This resolves itself into making the most economical use of copper. No longer may we double the number of bars and assume that the bus rating is doubled. Other means must be developed. A necessary preliminary to the solution involves the study of phenomena encountered in single-phase buses. A simple graphical method whereby the actual current distribution in multi-conductor buses may be ascertained is presented in this article. It points out the forces present tending to produce inequality of current distribution and discusses means of overcoming or annulling these forces. Though the article does not bear directly upon the three-phase problem, except as to the general nature of the phenomena encountered, it is very probable that the method described will be employed in all subsequent investigations of this nature. Therefore it should be of interest to both central-station and industrial engineers.

As is well known, any conductor carrying alternating current has produced in it magnetic lines of force, which on rising and falling create back electromotive forces of self-inductance. These electromotive forces vary both in magnitude and phase from point to point through the cross-section of the conductor, being larger in the middle and smaller toward the periphery. The result is to produce a non-uniform distribution of current of such character as to crowd the current toward the conductor surface; hence the term "skin effect." A measure of this distortion is given by the "skin-effect ratio," which is the relation of the thermal energy generated by the flow of alternating current to the thermal energy formed by the passage of the same value of direct current.

The distortion of the current increases with the frequency for a given conductor, but, as H. B. Dwight* has pointed out, the skin-effect ratio is an increasing function of the ratio $f/R$, where $f$ is the frequency and $R$ is the resistance. The physical significance of this relation may be better grasped by considering the unbalance of current density as merely due to circulating or eddy currents superimposed upon a uniform power current. At certain points the circulating currents add to the power current and at other points deduct from it. The induced voltages producing these currents are directly proportional to the frequency and are balanced by the resistance drop of the circulating currents. Hence to maintain a given current distribution with increased frequency it is only necessary to increase the resistance drop in the same proportion. Dwight's relation is of no importance here except as it elucidates the phenomenon connecting the radio art and busbar work. It shows that the distribution may be just as bad with low resistances as with high frequencies.




FIGS. 1, 2 AND 3—COMPARISON OF D.C. AND A.C. RATINGS OF MULTI-BAR BUS; METHOD OF STUDYING CURRENT DISTRIBUTION IN A.C. BUS, AND CONDITIONS OBSERVED IN A SPECIFIC CASE

Increasing number of bars does not increase rating to the same amount for alternating current and for direct current; insulated leads attached to busbar for studying current distribution; magnitudes and phase relations of currents in different portions of bar No. 6 in a ten-conductor bus. The curved line is the loci of vectors representing currents in different portions of the bar. As indicated, the current 1½ in. from the edge is about 145 deg. out of phase with that at the edge.

*Transactions A.I.E.E., 1918, page 1399.

The presence of neighboring conductors distorts the current distribution further. A rigorous mathematical investigation of the distribution in complicated composite buses with returns is impossible, although a few of the more simple cases have been found susceptible of analysis. Distortion also increases as the resistance decreases; this is the condition met with in busbar practice and the one in which we are interested.

### METHOD OF STUDYING CURRENT DISTRIBUTION

In an experimental investigation of this phenomenon the writer used the following method with marked success:

An insulated lead *c* was placed close to the bar under investigation and brought into electrical contact with it at *a* Fig. 2. With another tap *N* from *b* it was possible to form what is in effect a non-inductive shunt with filament *m*, that portion of the bar in immediate proximity to the lead. All lines of force which cut filament *m* likewise cut lead *c*, it being assumed that filament *m* and lead *c* are so close together that practically no lines of force may pass between them. The voltage across the terminals of *N* and *c* will then be affected only by and will be a measure of the resistance drop in filament *m*. Similarly, if another insulated lead *d* was secured along the bar, the voltage between it and the *N* lead will be proportional to the resistance drop in filament *n*.

So far, only the scalar values of the vectors have been considered. There remains to determine their phase relation. The voltage between the terminals of *c* and *d* will be equal to the vector difference of the *ir* drops. These three values are sufficient to construct a triangle which determines the phase relations of the *ir* drops (see Fig. 2). However, this gives no physical conception of the quantities.

The total drop along the bar between *b* and *a* consists of two components, namely, the resistance drop and the reactive drop. It is equal to the vector sum of the *ir* drop of any element and the reactive drop due to all the lines of force external to that element. Lines of force which do not cut the element do not contribute to the development of reactive drop. To be more specific, the total drop between *b* and *a* is equal to the vector sum of the *ir* drop in filament *m* and the reactive drop due to the flux external to *m* and is also equal to the vector sum of the *ir* drop in filament *n* and the reactive drop due to the flux external to *n*. By subtracting the reactive drop external to filament *n* from each of these equal sums, it becomes evident that the *ir* drop in filament *n* is equal to the vector sum of the *ir* drop in filament *m* and the voltage due to the flux between

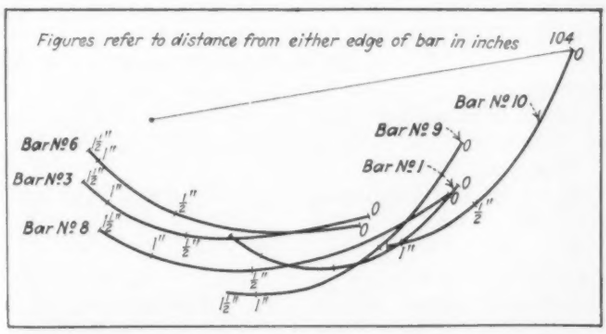



FIG. 4—LOCI OF VECTORS REPRESENTING CURRENTS IN BARS OF TEN-CONDUCTOR BUS

The current in the middle of bar No. 6 lags 160 deg. behind that at the edges of bar No. 10, which indicates that while the current in one part of the bus is flowing in one direction, that in another part is flowing in the opposite direction.

*m* and *n*. It will be noted that the two leads *c* and *d* with that portion of the bar at *a* form a complete rectangle or loop through which threads the flux between *m* and *n*. The voltage across the terminals of *c* and *d* will, therefore, be equal to the vector difference of the *ir* drops in filaments *m* and *n*.

Using the preceding method the current distribution in a ten-conductor copper bus of the section indicated by Fig. 3 was investigated. A current of 4,200 amp., 60 cycles, was used. Fig. 3 also shows the current distribution in different portions of bar No. 6. The figures along the curved line indicate the termini of the vectors representing current in filaments or laminæ distant

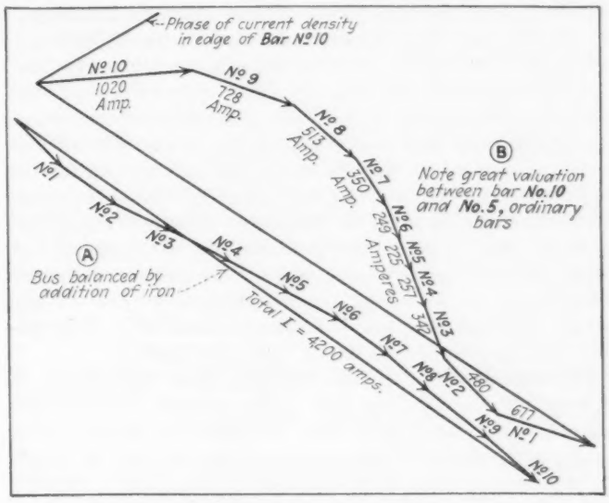



FIG. 5A AND B—CURRENT RELATIONS IN INDIVIDUAL BARS OF BALANCED AND UNBALANCED BUSES

from either edge an amount equal to the figures shown. This diagram indicates that the current density at the middle of the bar is but 29 per cent of that at the edge, and that these currents are out of phase 124 deg., the current in the middle lagging behind that near the edges. By dividing the bar into quarter-inch elements and by assuming the current density at ⅛ in., ⅜ in., ⅝ in. (3.1 mm., 9.5 mm., 15.8 mm.), etc., to be average densities for these elements, it is possible to obtain by the addition of the vectors the resultant *OA*, which is in phase with but equal in scalar value to six times average current density in the entire bar. Dividing by six and multiplying by the area, the total current in the bar is obtained. From a knowledge of the distribution it is but a simple step to determine the skin-effect ratio.

Similar diagrams for bars Nos. 1, 3, 6, 8, 9 and 10 are shown in Fig. 4. The vector marked 104 is used as a reference vector and is in phase with the current density at the edge of bar No. 10. It may be noted that the current in the middle of bar No. 6 lags 160 deg. behind that at the edges of bar No. 10, which signifies that at any instant while current in one part of the bar is flowing in one direction that in another part is flowing in the opposite direction.

It may be noted further that the loci do not overlap one another and form one continuous curve as might be expected. If a solid conductor in which the magnetic lines of force constitute a system of concentric loops is assumed, all elements of the conductor through which pass the same lines of force are cut by an equal number of lines, viz., those external to that line. These elements will then all have equal reactive drops, and since all elements of the conductor must have the same total drop along the conductor, they must likewise have the same *ir* drop and current density. Any other element will have a different reactive and *ir* drop. It may therefore be concluded that the current density at any point in a conductor with a concentric magnetic field may be

represented by a single locus. All points having equal reactive drops will likewise have equal current densities.

The foregoing argument fails, however, when the magnetic field is other than concentric. In the composite bus consisting of rectangular bars with air ducts between, each bar has linked about it magnetic lines of force which do not link other bars. Consequently, elements of the same magnitude of *ir* drop may be obtained, but they are not in phase. The best analogue is the leakage reactance of a transformer. This explains the necessity for a separate locus for every bar.

The relations between the total current in all the bars is shown in Fig. 5B, the smallest current value being 225 amp. and the largest 1,020 amp. Since these vectors have in no way been determined by the use of the ammeter readings, a comparison of the vector sum of these currents with the ammeter reading constitutes a check upon the method. This method indicated a total current of 4,380 amp., while the ammeter indicated 4,200 amp. Considering the magnitudes of the voltage drops involved and the instruments available, this appears to be a sufficient check upon the method.

Having determined the current distribution, it is interesting to consider how poor current distribution affects the rating of a bus. In the first place, there exists a maximum temperature of the bus above which it is unwise to run. Oxidation of the joints results, which increases their resistance. This in turn increases the thermal energy developed, thereby raising the temperature further. Above a certain temperature the effect is cumulative, so it is advisable to keep the maximum temperature below a certain safe working temperature. Non-uniform distribution within a bar increases its effective resistance and hence lowers the current rating for a given temperature rise. Unbalance of current between the bars not only increases the total energy formed but also increases the maximum local temperature. One bar may be working at the maximum allowable temperature while the other bars are cool. This results in poor economy and a very low rating for a given quantity of copper.

### FOUR METHODS OF INCREASING BUS RATING

How may the rating be increased? Several schemes have been proposed.

1. For low-voltage work, such as electric furnace installations, "interlacing" has been found most satisfactory. Direct-current rating is thus virtually obtained. However, "interlacing" must be restricted to low voltages.

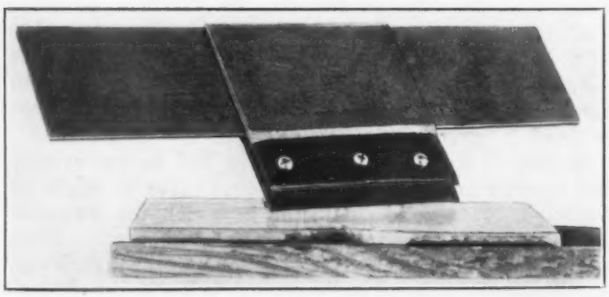


FIG. 6—SECTION OF A BUSBAR WITH BALANCER ATTACHED

2. The conductors may be regrouped in such a manner that the unbalance between bars and the distortion within the bars are decreased. One such arrangement is to form the bars in "hollow square," placing, say, four conductors, so that their centers coincide with the four corners of a square allowing space between.

3. The conductors may be transposed in a manner similar to the "transposition" used in transmission lines. This is possible in cases where a small number of conductors are involved or where long stretches of bus are employed.

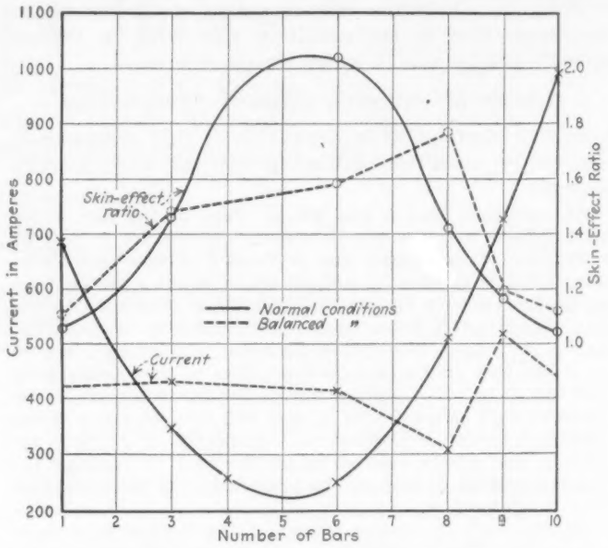



FIG. 7—CURRENT AND SKIN-EFFECT RATIO IN INDIVIDUAL BARS OF BALANCED AND UNBALANCED BUSES

4. Artificial inductance or balancers (Fig. 6) may be added to those bars carrying the greatest current. In this manner the current in all bars may be made equal.

Probably the most economical means is to regroup the conductors in a "hollow square" so as to reduce the skin-effect ratio of individual bars and then to correct for the unbalance between bars by means of artificial inductance. That it is possible to obtain absolute balance may be shown mathematically as follows:

Considering a pair of ten-conductor buses like the one shown in Fig. 3 with one constituting the return for the other, and assuming currents balanced in magnitude and phase, the voltage equation for bar No. 1 may be written:

$$e = ir + jwI(K_1 + M_{11} + M_{12} + M_{13} + M_{14} + M_{15} - M_{16} - M_{17} - M_{18} - M_{19} - M_{110})$$

where

$e$ = impressed emf. along the bars,
$I$ = current in each bar for the balanced condition,
$R$ = resistance of each bar,
$M_{12}$ = mutual inductance between bars Nos. 2 and 1, etc.,
$K_1$ = added inductance to bar No. 1, etc.

Five bars per bus are used merely for simplicity.

Similar equations may be formed for all bars. The necessary and sufficient condition that the currents in all bars be equal and in phase is that the scalar quantity in parentheses be equal for all bars. These quantities may be made so by varying the values of $K$.

By adding balancers of the type shown in Fig. 6 to the bus considered in Figs. 3 and 4 until approximate temperature balance was attained, the current distribution shown in Fig. 5A was obtained. A comparison of this figure with Fig. 5B indicates the effect of the balancers. The currents per bar are not only made equal in magnitude but are also in phase. The same results

are also shown in Fig. 7, the full lines referring to the normal condition and the dotted lines to the balanced bus. The improvement may be better appreciated if it is remembered that the temperature of the bars varies approximately as the square of the current. It is unfortunate that the ventilating conditions under which the test was made precluded the possibility of obtaining exact balance.

The skin-effect ratio of the individual bars is also shown in Fig. 7. The curve for the normal bus is symmetrical about a vertical axis, which indicates that the field due to the return has little influence upon the current distribution within individual bars. The principal effect of the return conductor is to augment the unbalance of current between the bars. With perfect balance it would be expected that the curve of skin-effect ratio would be symmetrical, but results do not bear this out. Bar No. 8 possesses the greater skin-effect ratio. This dissymmetry is probably due to the fact that bar No. 8 had too much iron, resulting in a small current. But the circulating currents would be altered very little, producing a greater distortion of the current and a greater skin-effect ratio. Assuming, then, a symmetrical curve, the maximum skin-effect ratio would be about 1.6. The balancers decreased the maximum skin-effect ratio from 2.04 to 1.6.

Similar investigations were made upon a single-phase bus consisting of four 4-in. x ¼-in. (10-cm. x 6.35-cm.) copper bars arranged in "hollow square." The bars were held in a horizontal position with the flat side vertical and separated 4 in. (10 cm.) horizontally and 2 in. (5 cm.) vertically. The distance between center line of buses was 16 in. (40 cm.).

The following table serves to compare a bus having ten 3-in. x ⅛-in. (75-mm. x 3.1-mm.) bars with a bus having four 4-in. (10-cm.) bars. The current rating for 30 deg. C. temperature rise is given below:

| Conditions | Amperes for 30 Deg. C. Temperature Rise Ten 3-In. x ⅛-In. Bars Separated ½-In. | Four 4-In. x ¼-In. Bars in Hollow Square |
|---|---|---|
| 60-cycle—normal | 2,700 | 3,600 |
| 60-cycle—balanced | 4,500 | 4,500 |
| 60-cycle—transposed (estimated) | ..... | 4,800 |
| Direct current | 6,250 | 5,300 |

The improvement with the addition of the balancers is evident for both cases. While "transposition" produces a further improvement, the practice is not warranted because of the increased complexity of the bus. It will further be noted that while the heat dissipation qualities of the ten-conductor bus, as evidenced by the direct-current rating, are better than those of the four-conductor bus, still the skin-effect ratio of the individual bars and the unbalance of current between them are so much greater as to maintain the same rating for the two buses.

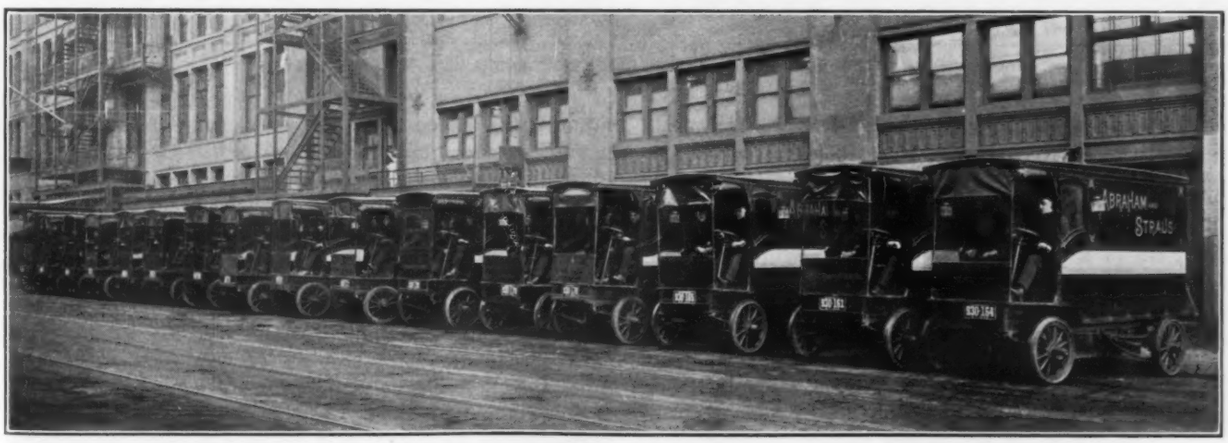
The skin-effect ratio of individual bars may be decreased by placing iron clips around the edges. The function of the clips is to increase the inductance of the edges, thus preventing the crowding of current to that part of the bar. They produce a more uniform distribution of current. In view of their structural disadvantages, the resulting increases in current rating do not warrant their use in practice.

While the information given in this article is directly applicable to single-phase installations, it has a broader usefulness in the development of a knowledge of current distribution, and therefore circuit design and rating, in three-phase systems.

# Economy of Electric Trucks for Delivery Use

### Large Brooklyn Department Store Has Found Them to Be Cheaper per Unit Hauled than Any Other Vehicle

"THIRTEEN years experience with electric trucks has satisfied us that for certain classes of work they are cheaper per unit hauled than any other type of vehicle," say Abraham & Straus, Inc., 422 Fulton Street, Brooklyn, N. Y., owners of one of the largest department stores in that borough. "For making deliveries we use electric trucks, gasoline trucks and horses, employing each type of vehicle in the zone of operation where we have found it the most economical. Our horses are used on trips requiring a mileage of less than 10, electric trucks are used for a daily mileage between 10 and 40, and gas trucks on a mileage between 40 and 130. "Our electric fleet consists of one 3½-ton truck purchased in 1908 and twenty 1-ton trucks of a different make, of which ten were bought in 1910 and ten in 1911. We operate in addition a number of horse routes and ninety-one gas trucks of ¾-ton, 2-ton, 3-ton and 5-ton capacity. We have been using gasoline trucks since




SIXTEEN OF THE TWENTY-ONE ELECTRIC TRUCKS COMPOSING FLEET OF LARGE BROOKLYN DEPARTMENT STORE

Of the vehicles shown, nine were purchased in 1910 and seven in 1911. Four of the trucks not pictured are like those shown, being rated at 2,000 lb. each. The remaining one is a 3½-ton truck, purchased in 1908. All of the trucks have been operated daily since they were purchased and have been found particularly economical for trips of 10 to 40 miles daily.

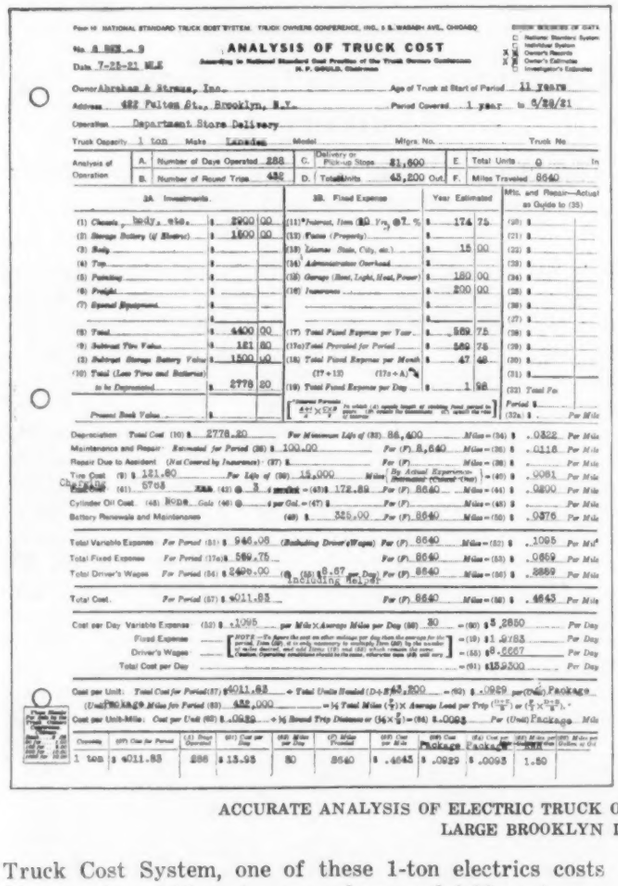
1913. The 1-ton 'electrics' deliver department-store merchandise of all kinds. They cover practically all of Brooklyn and in New York run uptown as far as Columbus Circle at Fifty-ninth Street. Their average daily mileage is 25, and they make between one and two trips. On the average each truck handles 150 packages a day. Since at some stops more than one package is delivered, the total number of delivery stops does not exceed eighty-five per day. The average load weighs about 1,500 lb.

"While we have actually had these trucks eleven and twelve years, we figure on a ten-year depreciation. Repairs and maintenance are very low, averaging only $100 a year per truck. We use almost no oil—simply pack the main bearings with grease once a year. We figure on operating a truck all but three weeks in the year, which gives us 288 operating days. Each truck carries a driver and a helper, the driver getting $30 a week and the helper $18. Figured on the National Standard Truck Cost System, one of these 1-ton electrics costs $13.93 a day, 9.29 cents per package and 0.93 cents per package-mile. The cost per delivery stop is 18.57 cents.

"The 3½-ton 'electric' is used for hauling merchandise, consisting mainly of drugs and candies, from our laboratory in New York City to our store in Brooklyn. It also picks up merchandise of this sort from various drug houses and similar concerns on its way to and from our store. Its average load is 3½ tons, and it makes one trip a day, averaging about 25 miles and twenty stops.

"We depreciate this truck also on a ten-year basis and allow $150 a year to cover repairs and maintenance. Of this amount about $25 is for battery maintenance. It has a driver and a helper, who are paid at the same rate as those on smaller cars. Figured on the National Standard Truck Cost System, this 3½-ton truck costs $16.07 per day, $4.59 per ton and 30.61 cents per ton-mile. These are very reasonable costs, which we know could not be equaled by gas trucks or horses.

"Besides being cheaper for the zones in which we use them, electric trucks are much more satisfactory from every point of view. They are easier to maintain and easier to control—it is much easier to teach a man how to drive an electric than a gas truck. Their limited speed is a big advantage because it saves wear and tear on the truck and tires and results in fewer accidents."



Form 10 NATIONAL STANDARD TRUCK COST SYSTEM. TRUCK OWNERS CONFERENCE, INC., 5 S. WABASH AVE., CHICAGO

No. 8 REK – 9

ANALYSIS OF TRUCK COST

According to National Standard Cost Practice of the Truck Owners Conference

H. P. GROUD, Chairman

Date 7-25-21 WLE

Owner Abraham & Straus, Inc. Age of Truck at Start of Period 11 years

Address 422 Fulton St., Brooklyn, N.Y. Period Covered 1 year to 6/30/21

Operation Department Store Delivery

Truck Capacity 1 Ton Make Lyradon Model Mfgrs. No. Truck No

Analysis of Operation: A. Number of Days Operated 288; B. Number of Round Trips 432; C. Delivery or Pick-up Stops $1,600; D. Total Units 45,200 Out; E. Total Units 0 In; F. Miles Traveled 8640

| 3A. Investments | | 3B. Fixed Expense | Year Estimated | Mtc. and Repair—Actual as Guide to (35) |
|---|---|---|---|---|
| (1) Chassis body, etc. | $ 2900 00 | (11)*Interest, Item (10) Yrs @ 7 % | $ 174 75 | (20) $ |
| (2) Storage Battery (if Electric) | $ 1600 00 | (12) Taxes (Property) | $ | (21) $ |
| (3) Body | $ | (13) Licenses (State, City, etc.) | $ 15 00 | (22) $ |
| (4) Top | $ | (14) Administration Overhead | $ | (23) $ |
| (5) Painting | $ | (15) Garage (Rent, Light, Heat, Power) | $ 180 00 | (24) $ |
| (6) Freight | $ | (16) Insurance | $ 200 00 | (25) $ |
| (7) Special Equipment | $ | | $ | (26) $ |
| | $ | | $ | (27) $ |
| (8) Total | $ 4400 00 | (17) Total Fixed Expense per Year | $ 569 75 | (28) $ |
| (9) Subtract Tire Value | $ 121 80 | (17a) Total Prorated for Period | $ 569 75 | (29) $ |
| (2) Subtract Storage Battery Value | $ 1500 00 | (18) Total Fixed Expense per Month | $ 47 48 | (30) $ |
| (10) Total (Less Tires and Batteries) to be Depreciated | $ 2778 20 | (17 ÷ 12) (17a ÷ A) | | (31) $ |
| Present Book Value | $ | (19) Total Fixed Expense per Day | $ 1 98 | (32) Total Per Period $ |
| | | [Interest Formula] | | (32a) $ Per Mile |

Depreciation Total Cost (10) $ 2778.20 For Minimum Life of (33) 86,400 Miles = (34) $ .0322 Per Mile

Maintenance and Repair Estimated for Period (35) $ 100.00 For (P) 8,640 Miles = (35) $ .0116 Per Mile

Repair Due to Accident (Not Covered by Insurance) (37) $ For (P) Miles = (38) $ Per Mile

Tire Cost (9) $ 121.80 For Life of (39) 15,000 Miles [By Actual Experience / Estimated (Correct One)] = (40) $ .0081 Per Mile

Charging Fuel Cost: (41) 5705 kWh (42) @ 3 ¢ per kWh = (43) $ 172.86 For (P) 8640 Miles = (44) $ .0200 Per Mile

Cylinder Oil Cost (45) None Gals (46) @ $ per Gal. = (47) $ For (P) Miles = (48) $ Per Mile

Battery Renewals and Maintenance (49) $ 325.00 For (P) 8640 Miles = (50) $ .0376 Per Mile

Total Variable Expense For Period (51) $ 946.06 (Excluding Driver's Wages) For (P) 8640 Miles = (52) $ .1095 Per Mile

Total Fixed Expense For Period (17a) $ 569.75 For (P) 8640 Miles = (53) $ .0659 Per Mile

Total Driver's Wages For Period (54) $ 2496.00 (@ $8.67 Per Day) Including Helper For (P) 8640 Miles = (55) $ .2889 Per Mile

Total Cost For Period (57) $ 4011.81 For (P) 8640 Miles = (58) $ .4643 Per Mile

Cost per Day: Variable Expense (52) $ .1095 per Mile × Average Miles per Day (59) 80 = (60) $ 8.2850 Per Day

Fixed Expense = (19) $ 1.9765 Per Day

Driver's Wages = (55) $ 8.6667 Per Day

Total Cost per Day = (61) $ 15.9300 Per Day

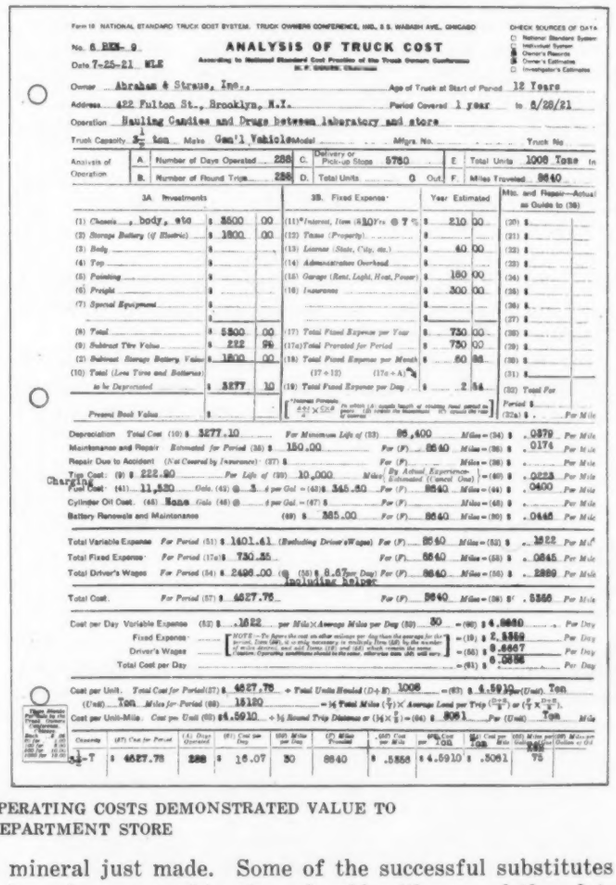
NOTE—To figure the cost on other mileage per day than the average for the period, Item (59), it is only necessary to multiply Item (60) by the number of miles desired, and add Items (19) and (55) which remain the same. Caution: Operating conditions should be the same, otherwise item (59) will vary.

Cost per Unit: Total Cost for Period (57) $ 4011.81 ÷ Total Units Hauled (D + E) 45,200 = (62) $ .0929 per (Unit) Package

(Unit) Package Miles for Period (63) 432,000 = ½ Total Miles (⅛) × Average Load per Trip (45,200/432) or (⅛ × 104.63).

Cost per Unit-Mile: Cost per Unit (62) $ .0929 ÷ ½ Round Trip Distance or (½ × ⅛) = (64) $ .0093 Per (Unit) Package Mile

| Classes | (57) Cost for Period | (A) Days Operated | (61) Cost per Day | (59) Miles per Day | (F) Miles Traveled | (62) Cost per Package | (64) Cost per Package Mile | (64a) Cost per Ton | (63) Miles per Package | (63) Miles per Ton Miles or Gals. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 ton | $ 4011.81 | 288 | $ 13.93 | 80 | 8640 | $ .4643 | $ .0929 | $ .0093 | 1.50 | |



Form 10 NATIONAL STANDARD TRUCK COST SYSTEM. TRUCK OWNERS CONFERENCE, INC., 5 S. WABASH AVE., CHICAGO

No. 6 REK – 9

ANALYSIS OF TRUCK COST

According to National Standard Cost Practice of the Truck Owners Conference

H. P. GROUD, Chairman

Date 7-25-21 WLE

Owner Abraham & Straus, Inc. Age of Truck at Start of Period 12 Years

Address 422 Fulton St., Brooklyn, N.Y. Period Covered 1 year to 6/30/21

Operation Hauling Candies and Drugs between laboratory and store

Truck Capacity 3½ ton Make Gen'l Vehicles Model Mfgrs. No. Truck No

Analysis of Operation: A. Number of Days Operated 288; B. Number of Round Trips 288; C. Delivery or Pick-up Stops 5760; D. Total Units 0 Out; E. Total Units 1008 Tons In; F. Miles Traveled 8640

| 3A. Investments | | 3B. Fixed Expense | Year Estimated | Mtc. and Repair—Actual as Guide to (35) |
|---|---|---|---|---|
| (1) Chassis body, etc. | $ 3500 00 | (11)*Interest, Item (10) Yrs @ 7 % | $ 210 00 | (20) $ |
| (2) Storage Battery (if Electric) | $ 1800 00 | (12) Taxes (Property) | $ | (21) $ |
| (3) Body | $ | (13) Licenses (State, City, etc.) | $ 40 00 | (22) $ |
| (4) Top | $ | (14) Administration Overhead | $ | (23) $ |
| (5) Painting | $ | (15) Garage (Rent, Light, Heat, Power) | $ 180 00 | (24) $ |
| (6) Freight | $ | (16) Insurance | $ 300 00 | (25) $ |
| (7) Special Equipment | $ | | $ | (26) $ |
| | $ | | $ | (27) $ |
| (8) Total | $ 5300 00 | (17) Total Fixed Expense per Year | $ 730 00 | (28) $ |
| (9) Subtract Tire Value | $ 222 90 | (17a) Total Prorated for Period | $ 730 00 | (29) $ |
| (2) Subtract Storage Battery Value | $ 1800 00 | (18) Total Fixed Expense per Month | $ 60 84 | (30) $ |
| (10) Total (Less Tires and Batteries) to be Depreciated | $ 3277 10 | (17 ÷ 12) (17a ÷ A) | | (31) $ |
| Present Book Value | $ | (19) Total Fixed Expense per Day | $ 2 54 | (32) Total Per Period $ |
| | | [Interest Formula] | | (32a) $ Per Mile |

Depreciation Total Cost (10) $ 3277.10 For Minimum Life of (33) 86,400 Miles = (34) $ .0379 Per Mile

Maintenance and Repair Estimated for Period (35) $ 150.00 For (P) 8640 Miles = (35) $ .0174 Per Mile

Repair Due to Accident (Not Covered by Insurance) (37) $ For (P) Miles = (38) $ Per Mile

Tire Cost: (9) $ 222.90 For Life of (39) 10,000 Miles [By Actual Experience / Estimated (Correct One)] = (40) $ .0223 Per Mile

Charging Fuel Cost: (41) 11,520 Gals (42) @ 3 ¢ per Gal = (43) $ 345.60 For (P) 8640 Miles = (44) $ .0400 Per Mile

Cylinder Oil Cost (45) None Gals (46) @ $ per Gal. = (47) $ For (P) Miles = (48) $ Per Mile

Battery Renewals and Maintenance (49) $ 385.00 For (P) 8640 Miles = (50) $ .0446 Per Mile

Total Variable Expense For Period (51) $ 1401.61 (Excluding Driver's Wages) For (P) 8640 Miles = (52) $ .1622 Per Mile

Total Fixed Expense For Period (17a) $ 730.55 For (P) 8640 Miles = (53) $ .0845 Per Mile

Total Driver's Wages For Period (54) $ 2496.00 (@ $8.67 Per Day) Including Helper For (P) 8640 Miles = (55) $ .2889 Per Mile

Total Cost For Period (57) $ 4627.76 For (P) 8640 Miles = (58) $ .5356 Per Mile

Cost per Day: Variable Expense (52) $ .1622 per Mile × Average Miles per Day (59) 80 = (60) $ 12.9760 Per Day

Fixed Expense = (19) $ 2.5359 Per Day

Driver's Wages = (55) $ 8.6667 Per Day

Total Cost per Day = (61) $ 24.1786 Per Day

NOTE—To figure the cost on other mileage per day than the average for the period, Item (59), it is only necessary to multiply Item (60) by the number of miles desired, and add Items (19) and (55) which remain the same. Caution: Operating conditions should be the same, otherwise item (59) will vary.

Cost per Unit: Total Cost for Period (57) $ 4627.76 ÷ Total Units Hauled (D + E) 1008 = (63) $ 4.5910 per (Unit) Ton

(Unit) Ton Miles for Period (63) 15120 = ½ Total Miles (⅛) × Average Load per Trip (1008/288) or (⅛ × 3½).

Cost per Unit-Mile: Cost per Unit (63) $ 4.5910 ÷ ½ Round Trip Distance or (½ × ⅛) = (64) $ .5361 Per (Unit) Ton Mile

| Classes | (57) Cost for Period | (A) Days Operated | (61) Cost per Day | (59) Miles per Day | (F) Miles Traveled | (62) Cost per Package | (64) Cost per Ton Mile | (64a) Cost per Ton | (63) Miles per Package | (63) Miles per Ton Miles or Gals. |
|---|---|---|---|---|---|---|---|---|---|---|
| 3½-T | $ 4627.76 | 288 | $ 16.07 | 30 | 8640 | $ .5356 | $ .5361 | $ 4.5910 | 75 | |

ACCURATE ANALYSIS OF ELECTRIC TRUCK OPERATING COSTS DEMONSTRATED VALUE TO LARGE BROOKLYN DEPARTMENT STORE

## Substitutes for Platinum in Electrical Apparatus

SATISFACTORY substitutes have been found for platinum for various purposes, but in some chemical requirements and for use in high-duty electrical contacts no substitute has been found, the United States Bureau of Mines declares as the result of a study of this mineral just made. Some of the successful substitutes have been a combination of gold with one of the platinum metals. One known as palau (a combination of gold and palladium) resists the activity of most of the reagents; another, "rhotanium," is held to make a good substitute for electrical heating units. One of the most promising substitutes is the so-called "white gold," which is an alloy of gold and one of the platinum metals. This quite closely resembles platinum and is not attacked by nitric acid. A substitute successfully used in relay contacts when the voltage is low is made with nickel, chromium and tungsten, and this is used to some extent in dentistry. Another substitute for electrical purposes is a compound made with 70 per cent silver, 25 per cent palladium and 5 per cent cobalt. Many other alloys have also been patented as platinum substitutes.

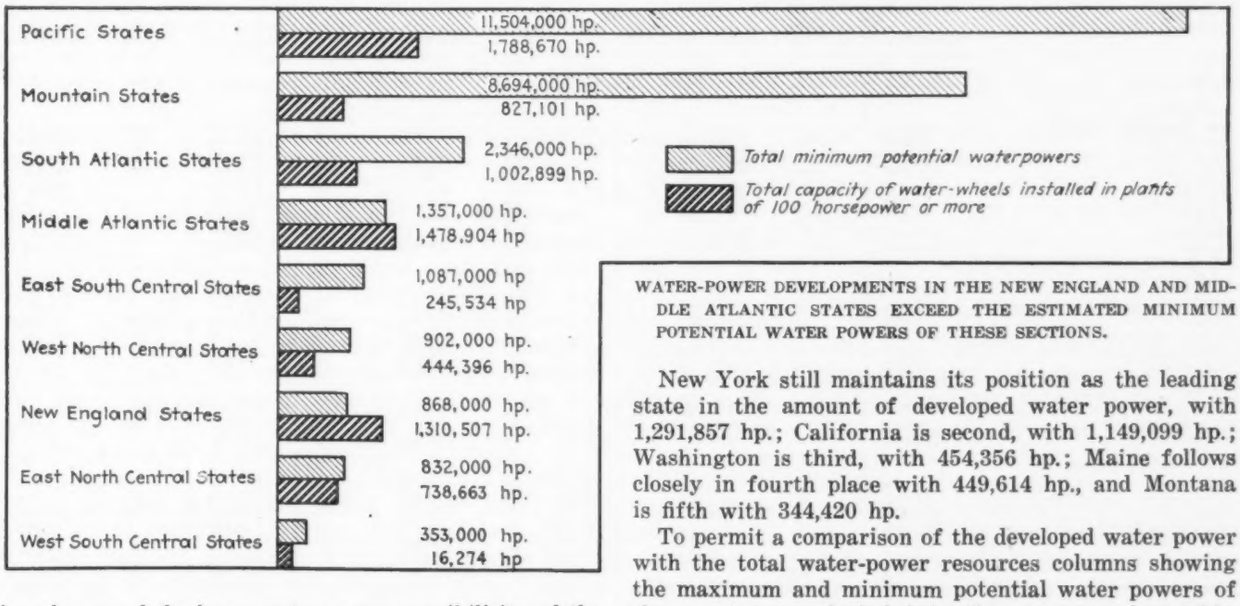
# Developed and Potential Water Powers of the United States

## Government Compilation Indicates that Capacity of Waterwheels Installed in Plants of 100 Hp. or More Is 7,852,948 Hp. —Almost 80 per Cent in Public Utility Generating Plants

WATER-POWER development is progressing rapidly in the United States. The large number of applications on file with the Federal Power Commission for permits and licenses clearly indicates the large amount of thought which is being given to this type of motive power. The Muscle Shoals project now before Congress is only one of the large water-power possibilities of the country. An available market for energy generated and a return to a normal financial status will, without doubt, bring more of them into the limelight.

The United States Geological Survey has just finished an investigation to determine the capacity of the waterwheels installed in plants rated at 100 hp. and over. The results are given in the accompanying table. These data were collected by the district engineers of the survey by correspondence or by personal visits to the plants. In 1908 the Bureau of the Census made a special census of the developed water powers of the country for the report of the National Conservation Commission. This census indicated that there were in the United States 31,537 water-power plants of all sizes, whose waterwheel capacity was 5,356,680 hp. The returns indicated that many very small plants were included in the survey as the reports showed only 602 plants with a capacity over 1,000 hp. The capacity of these 602 plants was 3,900,000 hp., leaving 1,457,000 hp. to be distributed among 30,935 plants with an average capacity of only 47 hp.

The survey just completed by the Geological Survey indicates that at the present time there are 3,116 water-power plants of 100 hp. or more, with a total installed waterwheel capacity of 7,852,948 hp. Of this total, 79 per cent is in public utility plants and 21 per cent in manufacturing plants. It is of interest to note that the census of 1908, which embraced plants of all sizes, included ten times as many plants as the present report, but it must be remembered that the present report embraces only plants of 100 hp. or more.




WATER-POWER DEVELOPMENTS IN THE NEW ENGLAND AND MIDDLE ATLANTIC STATES EXCEED THE ESTIMATED MINIMUM POTENTIAL WATER POWERS OF THESE SECTIONS.

New York still maintains its position as the leading state in the amount of developed water power, with 1,291,857 hp.; California is second, with 1,149,099 hp.; Washington is third, with 454,356 hp.; Maine follows closely in fourth place with 449,614 hp., and Montana is fifth with 344,420 hp.

To permit a comparison of the developed water power with the total water-power resources columns showing the maximum and minimum potential water powers of the country are included in the accompanying table. These potential water-power figures are based on the estimates made by the United States Geological Survey in 1908 for the National Conservation Commission and revised by the Commissioner of Corporations for his report on water-power development in the United States in 1912 and by the United States Forest Service in the year 1916.

In comparing the figures of developed water power and potential water power for any state or group of states as given in this table, the basis for the data should be kept clearly in mind if gross and absurd errors are to be avoided. The potential water power of the United States was determined by dividing the rivers into sections of different lengths, the lengths depending on the slope of the channel, and the fall and flow of each section was determined from the best information available. With these factors the potential water power of each stream was determined on the assumption of an efficiency of 75 per cent in the waterwheels. The portions of the stream where the slope is so small that water power can probably never be profitably developed were not included.

The minimum potential water power is based on the average flow of the two seven-day periods of lowest

flow in each year of record. This, of course, does not give the absolute minimum flow, but for all practical purposes potential water power based on this flow may be considered as continuous power. The maximum potential water power is based on the flow available for 50 per cent of the time. The use of storage was not considered in making the estimate of either minimum or maximum potential water power. The estimates of both minimum and maximum potential water power are considered conservative.

It is a general practice in the construction of water-power plants to install hydraulic machinery capable of utilizing stream flow far in excess of the absolute minimum and much in excess of the flow used in determining the minimum water power as given in the table. This practice is forcibly brought out by comparing the minimum potential water power with the total capacity of waterwheels installed in water-power plants in some of the New England States. If all the water powers of the United States were similarly developed, it would probably be necessary to install plants having three or four times the capacity of the estimated minimum potential water power as shown in the table. This condition should be fully considered when estimating the amount of potential water power that may still be available in any state at the present time.

## Potential and Larger Developed Water Powers of the United States

| State and Section | Potential Water Powers | | | | Capacity of Waterwheels Installed in Plants of 100 Hp. or More | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Minimum | | Maximum | | Total | | Public Utility and Municipal | | Manufacturing and Miscellaneous | |
| | Horsepower | Per Cent of Total | Horsepower | Per Cent of Total | Number of Plants | Capacity in Horsepower | Number of Plants | Capacity in Horsepower | Number of Plants | Capacity in Horsepower |
| United States | 27,943,000 | 100.00 | 53,905,000 | 100.00 | 3,116 | 7,852,948 | 1,322 | 6,200,245 | 1,794 | 1,652,703 |
| SECTIONS: | | | | | | | | | | |
| New England | 868,000 | 3.11 | 1,605,000 | 2.98 | 1,234 | 1,310,507 | 246 | 583,130 | 988 | 727,377 |
| Middle Atlantic | 1,357,000 | 4.86 | 2,488,000 | 4.62 | 551 | 1,478,904 | 215 | 1,167,539 | 336 | 311,365 |
| South Atlantic | 2,346,000 | 8.39 | 4,257,000 | 7.90 | 260 | 1,002,899 | 127 | 799,632 | 133 | 203,267 |
| East North Central | 832,000 | 2.98 | 1,604,000 | 2.98 | 323 | 738,663 | 192 | 542,889 | 131 | 195,774 |
| West North Central | 902,000 | 3.23 | 1,956,000 | 3.63 | 179 | 444,396 | 112 | 360,625 | 67 | 83,771 |
| East South Central | 1,087,000 | 3.89 | 1,964,000 | 3.64 | 43 | 245,534 | 25 | 228,380 | 18 | 17,154 |
| West South Central | 353,000 | 1.26 | 822,000 | 1.52 | 26 | 16,274 | 12 | 12,515 | 14 | 3,759 |
| Mountain | 8,694,000 | 31.11 | 16,131,000 | 29.92 | 223 | 827,101 | 173 | 806,472 | 50 | 20,629 |
| Pacific | 11,504,000 | 41.17 | 23,078,000 | 42.81 | 277 | 1,788,670 | 220 | 1,699,063 | 57 | 89,607 |
| NEW ENGLAND: | | | | | | | | | | |
| Maine | 443,000 | 1.59 | 809,000 | 1.50 | 256 | 449,614 | 71 | 156,549 | 185 | 293,065 |
| New Hampshire | 135,000 | .48 | 246,000 | .46 | 242 | 229,305 | 59 | 112,865 | 183 | 116,440 |
| Vermont | 94,000 | .33 | 172,000 | .32 | 206 | 129,566 | 59 | 72,651 | 147 | 56,915 |
| Massachusetts | 118,000 | .43 | 228,000 | .42 | 346 | 338,057 | 32 | 157,605 | 314 | 180,452 |
| Rhode Island | 6,000 | .02 | 13,000 | .02 | 60 | 30,136 | 5 | 3,510 | 55 | 26,626 |
| Connecticut | 72,000 | .26 | 137,000 | .26 | 124 | 133,829 | 20 | 79,950 | 104 | 53,879 |
| MIDDLE ATLANTIC: | | | | | | | | | | |
| New York | 1,037,000 | 3.71 | 1,698,000 | 3.15 | 473 | 1,291,857 | 164 | 993,601 | 309 | 298,256 |
| New Jersey | 44,000 | .16 | 106,000 | .20 | 30 | 17,051 | 10 | 8,883 | 20 | 8,168 |
| Pennsylvania | 276,000 | .99 | 684,000 | 1.27 | 48 | 169,996 | 41 | 165,055 | 7 | 4,941 |
| SOUTH ATLANTIC: | | | | | | | | | | |
| Delaware | 5,000 | .02 | 11,000 | .02 | 9 | 3,133 | 0 | 0 | 9 | 3,133 |
| Maryland and D. of C. | 48,000 | .17 | 133,000 | .24 | 23 | 7,896 | 6 | 2,120 | 17 | 5,776 |
| Virginia | 492,000 | 1.76 | 870,000 | 1.61 | 71 | 103,693 | 35 | 76,551 | 36 | 27,142 |
| West Virginia | 381,000 | 1.36 | 1,051,000 | 1.95 | 11 | 14,675 | 6 | 8,410 | 5 | 6,265 |
| North Carolina | 578,000 | 2.07 | 875,000 | 1.62 | 70 | 255,843 | 30 | 126,070 | 40 | 129,773 |
| South Carolina | 460,000 | 1.64 | 677,000 | 1.25 | 21 | 330,012 | 16 | 321,250 | 5 | 8,762 |
| Georgia | 374,000 | 1.34 | 627,000 | 1.16 | 52 | 281,111 | 32 | 262,495 | 20 | 18,616 |
| Florida | 8,000 | .03 | 13,000 | .02 | 3 | 6,536 | 2 | 2,736 | 1 | 3,800 |
| EAST NORTH CENTRAL: | | | | | | | | | | |
| Ohio | 59,000 | .21 | 178,000 | .33 | 25 | 28,663 | 17 | 24,236 | 8 | 4,427 |
| Indiana | 43,000 | .16 | 118,000 | .22 | 26 | 27,122 | 13 | 21,236 | 13 | 5,886 |
| Illinois | 192,000 | .69 | 345,000 | .64 | 41 | 85,002 | 15 | 73,591 | 26 | 11,411 |
| Michigan | 180,000 | .64 | 293,000 | .55 | 97 | 267,139 | 81 | 228,353 | 16 | 38,786 |
| Wisconsin | 358,000 | 1.28 | 670,000 | 1.24 | 134 | 330,737 | 66 | 195,473 | 68 | 135,264 |
| WEST NORTH CENTRAL: | | | | | | | | | | |
| Minnesota | 232,000 | .83 | 494,000 | .92 | 56 | 205,180 | 35 | 145,247 | 21 | 59,933 |
| Iowa | 160,000 | .57 | 382,000 | .71 | 48 | 173,437 | 32 | 169,614 | 16 | 3,823 |
| Missouri | 72,000 | .26 | 163,000 | .30 | 7 | 17,970 | 5 | 17,670 | 2 | 300 |
| North Dakota | 88,000 | .31 | 207,000 | .38 | 1 | 245 | 0 | 0 | 1 | 245 |
| South Dakota | 43,000 | .16 | 75,000 | .14 | 8 | 18,227 | 5 | 6,050 | 3 | 12,177 |
| Nebraska | 196,000 | .70 | 366,000 | .68 | 39 | 14,726 | 25 | 12,036 | 14 | 2,690 |
| Kansas | 111,000 | .40 | 269,000 | .50 | 20 | 14,611 | 10 | 10,008 | 10 | 4,603 |
| EAST SOUTH CENTRAL: | | | | | | | | | | |
| Kentucky | 83,000 | .30 | 197,000 | .37 | 5 | 855 | 1 | 115 | 4 | 740 |
| Tennessee | 463,000 | 1.66 | 761,000 | 1.41 | 22 | 126,891 | 15 | 125,865 | 7 | 1,026 |
| Alabama | 509,000 | 1.82 | 943,000 | 1.74 | 16 | 117,788 | 9 | 102,400 | 7 | 15,388 |
| Mississippi | 32,000 | .11 | 63,000 | .12 | 0 | 0 | 0 | 0 | 0 | 0 |
| WEST SOUTH CENTRAL: | | | | | | | | | | |
| Arkansas | 22,000 | .08 | 61,000 | .11 | 2 | 1,189 | 1 | 720 | 1 | 469 |
| Louisiana | 1,000 | .00 | 2,000 | .00 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oklahoma | 75,000 | .27 | 208,000 | .39 | 4 | 1,718 | 4 | 1,718 | 0 | 0 |
| Texas | 255,000 | .91 | 551,000 | 1.02 | 20 | 13,367 | 7 | 10,077 | 13 | 3,290 |
| MOUNTAIN: | | | | | | | | | | |
| Montana | 2,749,000 | 9.84 | 4,331,000 | 8.03 | 28 | 344,420 | 26 | 342,480 | 2 | 1,940 |
| Idaho | 2,362,000 | 8.45 | 5,067,000 | 9.40 | 45 | 224,368 | 41 | 222,471 | 4 | 1,897 |
| Wyoming | 773,000 | 2.76 | 1,305,000 | 2.42 | 9 | 7,560 | 9 | 7,560 | 0 | 0 |
| Colorado | 842,000 | 3.01 | 1,697,000 | 3.15 | 57 | 91,648 | 28 | 79,708 | 29 | 11,940 |
| New Mexico | 160,000 | .57 | 439,000 | .81 | 3 | 799 | 3 | 799 | 0 | 0 |
| Arizona | 893,000 | 3.20 | 1,698,000 | 3.15 | 8 | 38,760 | 8 | 38,760 | 0 | 0 |
| Utah | 743,000 | 2.66 | 1,318,000 | 2.45 | 64 | 106,096 | 51 | 101,844 | 13 | 4,252 |
| Nevada | 172,000 | .62 | 276,000 | .51 | 9 | 13,450 | 7 | 12,850 | 2 | 600 |
| PACIFIC: | | | | | | | | | | |
| Washington | 4,932,000 | 17.65 | 8,647,000 | 16.04 | 69 | 454,356 | 62 | 443,139 | 7 | 11,217 |
| Oregon | 3,148,000 | 11.27 | 6,613,000 | 12.27 | 74 | 185,215 | 52 | 125,970 | 22 | 59,245 |
| California | 3,424,000 | 12.25 | 7,818,000 | 14.50 | 134 | 1,149,099 | 106 | 1,129,954 | 28 | 19,145 |

# Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

## Demand for Engineers with Commercial or Executive Ability

*To the Editors of the* ELECTRICAL WORLD:

Recently William L. Goodwin expressed what we have all recognized, namely, that we have an oversupply of men who can handle mathematical, design and other engineering problems, provided the problems are stated for them, and, further, provided the results are applied for them. At the same time there is a lack of men who should have engineering training but must have the ability to see the problems and take the commercial and executive action to put their engineering knowledge into practical use—in other words, to sell the engineering ideas.

From the few brilliant exceptions it becomes evident that in general something is lacking in the average run of engineering graduates which, if present, would very much enhance their value to the industry. We are inclined to say that something is wrong with engineering education. I think it would be truer to say that there is a need of further improvement in engineering education. Moreover, I believe it is up to the industries to indicate to the colleges which way to turn rather than blame the colleges for the quality of their product.

The men seem to be fairly well trained to do certain things, but they cannot be readily molded to do the things which are needed. They lack what we might call a business sense, an ability to see profitable solutions, to educate consumers regarding the value of engineering improvements, and to convince people that such value is there, in practice as well as in theory.

Changes in college training will undoubtedly help somewhat. That is not enough, however, and we need not only a different training but a different selection of men for the commercial engineering job. Let me suggest by analogy. When a college attains a reputation in some athletic sport—as, for example, football or rowing—it seems able to maintain its supremacy for a long period of time. I think there is a reason for this which goes deeper than any particular system of training. Is it not because those boys who have a facility for a particular sport incline to choose a college which excels in it, and does not this act as a selective force to provide better than average material on which to work?

While I believe in organized training, I do believe that the individuality of a man is a greater power than any influence of any special system of training. You cannot make a silk purse out of a sow's ear. Some men with relatively little training make greater runners, and others cannot excel as runners even though they are physically strong and receive the best sort of extended training. They, of course, can be improved, but not made into real leaders in the sport.

These extremes indicate what exists, in a smaller degree, in all men, and I believe that the parallel exists in men's vocational traits. I believe that at the time when men enter college some have qualifications which make it relatively easy to train them into laboratory or research engineers, others into general designing or operating engineers, still others into commercial sales management or consulting engineers or engineering executives. If these men could be correctly classified and trained in the direction indicated by their dominating talents, the question would be solved. Further, I believe if the problem was properly presented, the men would tend to classify themselves, either at entrance or during their college courses, with a surprising degree of accuracy.

Taking the situation as it is today, it seems to me that the reputation of the engineering professions and of the engineering colleges is drawing into the engineering courses just the kind of young men who make the class of engineers of which there is an oversupply, while other businesses and professions are inspiring and drawing into their folds the kind of men who would readily develop business or commercial sense. Of course, some men with business talents do stray into the engineering courses, but if they are the least bit weak in mathematical or some technical line, they are sifted out by the flunking process and thus switched back into another line of business.

To carry out the new idea (if it be new) we would still have courses for research and general engineering, perhaps very much as they are now; but it would seem necessary to create new courses or options whereby those with business aptitude could avoid the extremes of specialized technics and receive instead training on commercial methods, ethics, law, etc. As soon as such options were available the industries co-operating with the colleges should, by means of publicity, divert into such courses a reasonable proportion of young men having commercial tendencies.

Of course, such a scheme would require a broad, comprehensive plan and organization, but I think it would be practicable to work in that direction and to make marked progress in a very short time. It seems evident that such a movement would not only insure better futures for all classes of engineers, but would also mean more efficient handling of the country's technical graduates.

G. H. STICKNEY,
Illuminating Engineering Assistant
Edison Lamp Works, to Sales Manager.
Harrison, N. J.

## Stokers with 645 Sq.Ft. of Grate Area for Paris Plant

*To the Editors of the* ELECTRICAL WORLD:

In your Jan. 21 issue, on page 129, there is a short article headed "Water-Cooled Generators in 200,000-Kw. Plant in Paris." In connection with this plant your readers may be interested to know that our French licensees are installing at this station Riley underfeed stokers which we feel quite sure are the largest in the world in grate area. Each boiler is equipped with two eighteen-retort extra-long stokers set back to back with a grate surface of 645 sq.ft.

Detailed information on this installation will be available shortly.

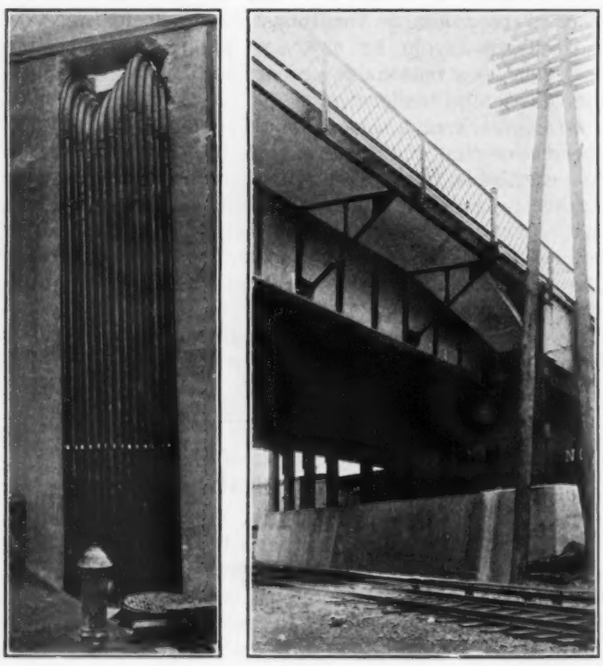
O. C. SHELDON.
Sanford Riley Stoker Company,
Worcester, Mass.

# Industrial and Station Practice

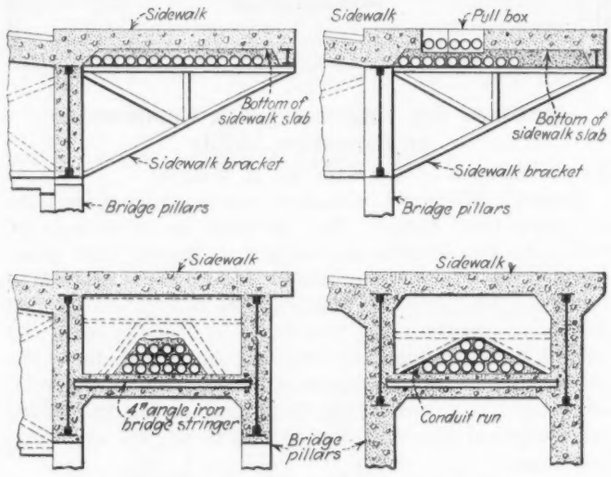
Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

## Circuits Over Railroad Run in Conduit Under Bridge Sidewalk

IN UNDERGROUND conduit installations it is sometimes necessary to resort to special or unusual forms of construction to overcome obstacles in the route of the subway. Such a condition was encountered by the New York & Queens Electric Light & Power Company in the construction of a heavy duct line in Long Island City, where it was necessary to cross the Sunnyside yards of the Pennsylvania Railroad. These yards extend for a distance of about 2½ miles and are crossed by five viaducts. The viaducts are either all-steel or a combination of steel sections and earth-fill sections. The route of the subway crosses one of the all-steel viaducts approximately ¼ mile long, and at this location the subway consists of fifteen 4-in. ducts. In the underground section of the subway fiber duct is used. The subway meets the viaduct approach, which is filled in between retaining walls, through a street running at an angle of about 45 deg. to the viaduct and at a level approximately 30 ft. below the level of the viaduct. The fiber conduits were terminated in a manhole in the lower street close to the viaduct retaining wall, and iron conduits were carried out of the roof of the manhole, up the face of the retaining wall and through the upper part of the wall into a manhole constructed at the viaduct level. The conduits were strapped to the wall and incased in concrete. The photograph on the left shows these conduits before strapping and concreting.



OVERHEAD CONDUIT CONSTRUCTION TO CROSS RAILROAD YARDS




SUBSTRUCTURE OF BRIDGE USED TO SUPPORT CONDUIT

Upper sketches are the usual construction under sidewalks, while the lower show arrangements in special cases to clear obstructions.

Across the steel structure for a distance of 830 ft., fifteen 4-in. iron conduits are carried in a space under the sidewalk and resting on one of the steel members in the sidewalk bracket. Steam trains are operated under the viaduct, and to prevent corrosion the conduits were incased in concrete. A light-mesh reinforcement was wrapped around the conduits, bottom and side forms were placed, and the concrete was poured through holes cut in the sidewalk above. The completed construction is shown in the right-hand photograph.

In order to pull and splice the cables, three splicing boxes were constructed near the middle of the span. These boxes were constructed of sheet steel and angles and are 3 ft. 5 in. square and 12 in. deep. They have checkered steel-plate covers. Five cables pass through each box, the boxes being staggered. Removable partitions of 1-in. asbestos board are provided to separate the cable splices.

W. C. BLACKWOOD,
Electrical Engineer.
New York & Queens Electric Light & Power Company,
New York, N. Y.

## Locating Proper Brush Position with a Voltmeter

SETTING brushes by means of the "fiber" brush described by Philip G. Bernholz in the issue of Nov. 5, 1921, is satisfactory in its results, but cumbersome, as it requires a differently sized, carefully dimensioned brush for each machine. The same readings and conclusions may be obtained and deduced by the use of two "points" applied to the commutator while running.

These points should be made of two pieces of No. 10 brass wire about 6 in. long, insulated their whole length, with tape or varnished cloth tubing to within ½ in. of the ends, which are pointed for application to commu-

tator. These two rods are then soldered to voltmeter leads and the joints are carefully taped. They may also be taped together with ends even or held together with the hand, just as two pencils could be held together, when applying them to the commutator. No. 14 duplex copper wire may be used, but brass is better.

By moving these points to right or left on the surface of the commutator with the machine running at normal speed with full voltage applied, a series of readings may be obtained on an ordinary voltmeter which will give very complete data on the voltage conditions under and about the brush at any load, speed or field conditions.

Unless the machine is of the reversible type, it is well to adjust brushes so that the full-load neutral point—that is, the point where voltmeter reads zero on the commutator—is under the leading edge of the brush of a generator or motor, so that the brushes will carry no short-circuiting current when the segments pass from under them. In any case brushes should be adjusted so that the neutral point is always under some part of the brush at all conditions of load.

If neutral moves "back" against rotation of a motor or "ahead" with rotation of a generator, nothing can be done to strengthen interpoles except to wind on more wire. If the neutral moves the opposite way, however—that is, with rotation of a motor and against rotation of a generator—the interpoles should be weakened by adjusting a German-silver shunt across the terminals of the interpole circuit and the current adjusted so the neutral will stay in the same position at all loads, directly under the center or front half of the brush.

This "shunting" operation is sometimes necessary on regular commercial machines, as the manufacturers' testing forces are not infallible. EDWARD A. GIBBS.

Boston, Mass.

## Precautions Must Be Taken When Using Fire Extinguishers

THE liquid used in most fire extinguishers for fighting electrical fires is carbon tetrachloride. This liquid, when heated by contact with fire or otherwise, gives off certain chemical fumes or gases which blanket the fire and extinguish it by shutting off the air.

The fumes or gases from carbon tetrachloride cannot be breathed if present in any large quantity. Free chloride forms a corrosive acid in nose, mouth, throat and lungs, producing a choking sensation. Hydrogen chloride and phosgene may be present—the latter a deadly poison if the supply of air is deficient. If the ventilation is fairly good, the phosgene is absorbed by the air and becomes harmless. The fumes, or the carbon tetrachloride itself before it is used on a fire, also have an anæsthetic effect similar to chloroform and may produce unconsciousness.

It is necessary to exercise great caution in the use of carbon tetrachloride in extinguishing fires in confined or poorly ventilated places, such as basements, closets, wire tunnels at points under a roof or close to the ceiling, and in any other place where smoke and fumes may become pocketed. The smallest possible quantity of the liquid should be used. Employees should be cautioned not to remain in the vicinity of such confined locations longer than is necessary, but should get out into fresh air as soon as possible. Where there are confined spaces in which fires are likely to occur a properly made gas mask will afford protection.

In case a person is overcome by carbon-tetrachloride fumes he should be removed to fresh air immediately, and if breathing is faint or suspended, the prone-pressure method of resuscitation should be applied.

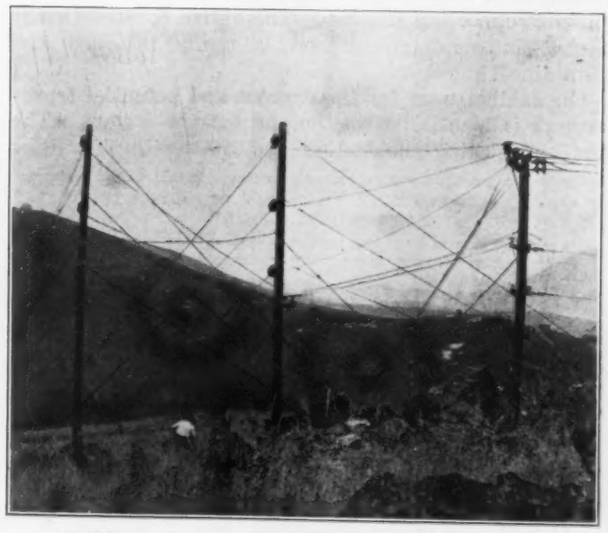
Men whose duties require that they work in the small substations and in confined spaces in the larger steam plants, such as the basement, should exercise special caution in the use of carbon tetrachloride and should ventilate or change the air after its use.

Consumers' Power Company, H. J. BURTON.
Jackson, Mich.

## Aerial Span of 2,300 Ft. in Satisfactory Service for Nine Years

ALTHOUGH bridging a distance of 2,300 ft., an unusually good record for freedom from trouble is held by a transmission span on the lines of the San Joaquin (Cal.) Light & Power Corporation. During nine years of service only one transmission cable has failed and recently one telephone wire came down.

A span of this length is necessary where two circuits cross the Kings River among the foothills just below Piedra. One of these circuits is for 66,000 volts and runs 145 miles along the eastern edge of the San Joaquin Valley from the Fresno Copper Mine to Bakersfield. The other is an 11,000-volt line that joins the 66,000-volt line at the Kings River crossing. These two circuits each consist of three No. 4/0 aluminum stranded cables. For the span, which is the longest in the entire system of the company, each circuit is run to separate poles. The three wires in each case are spaced 10 ft. apart vertically on 50-ft. poles at each end. A guy for each wire takes the strain of the span and the poles are also guyed at right angles to take care of the wind load due to winds blowing up and down the canyon. One telephone wire is run beneath the power wires on each pole. No calculations as to stresses were made at the time of erection as points of support were so high above the canyon floor. Calculations were recently made showing a sag of 450 ft. This indicates a low stress in the wires and helps to explain the satisfactory operation.



A 2,300-FT. SPAN IS SUPPORTED BY EACH OF THE POLES ON THE LEFT

San Joaquin Light & Power Co., L. J. MOORE,
Fresno, Cal. Electrical Engineer.

# Outdoor Meter Installations Facilitated by Standardizing Construction

BY STANDARDIZING the construction and mounting of outdoor meter cabinets and equipping them in advance of installation, the Ohio Power Company, Newark, Ohio, has been able to complete installations 30 miles from headquarters within one day after the order has been received. One standard design of cabinet will accommodate any metering outfit required for loads ranging from 50 kva., 220 volts, to 1,200 kva., 4,000 volts. The equipment is of the pole type, consisting of a transformer cabinet, a meter cabinet and conduit connecting the two. The entire construction is flexible in arrangement and is easily installed and maintained.

The cabinet used for the current and potential transformers is identical with the one for the meters. The detail of placing the meters and the testing facilities are shown in Fig. 1 on the left. The size of the cabinet allows the use of a kilowatt-hour meter, a reactive volt-ampere-hour meter and a demand meter. There is also sufficient space to install a graphic voltmeter or ammeter for special testing of complaints.

The instrument-transformer cabinet for a three-phase, four-wire, 4,000-volt installation using three current transformers and two potential transformers is shown in the center of the same illustration. To use this cabinet on three-phase, three-wire, 4,000-volt, or three-phase, three-wire, 2,200-volt circuits, the middle current transformer can be omitted and the type of potential transformers changed. If the initial installation was for a three-phase, three-wire, 2,200-volt circuit and it is necessary to change to three-phase, four-wire, 4,000-volt, one current transformer is added and the meter changed, which may be done at very small expense of material and labor.

In the case of a customer requiring a three-phase, three-wire, 220-volt installation the current transformers and meters are placed in a single cabinet as shown on the right of Fig. 1. The lines feeding this equipment may either come down the pole in conduit or run on insulators supported on the cross-arms with steel pins. The conduit method is much preferred and has been adopted by this company.

For the connections between the instrument transformer cabinet and the meter cabinet a standard 10-ft. length of galvanized conduit is used containing a multi-colored six-conductor, 600-volt cable. The three conductors to the current transformer are red, green and blue respectively with a common current return of black. Potential connections are red and white for one transformer and blue and white for the other, with a common return of black.

The wiring in the cabinets is all done in the meter department work shop under ideal conditions by the construction man. This wiring is checked before it leaves the work shop by the meter superintendent or his assistant. Even the cable is checked for colors. Before leaving the shop the conduit is cut and bent to size and

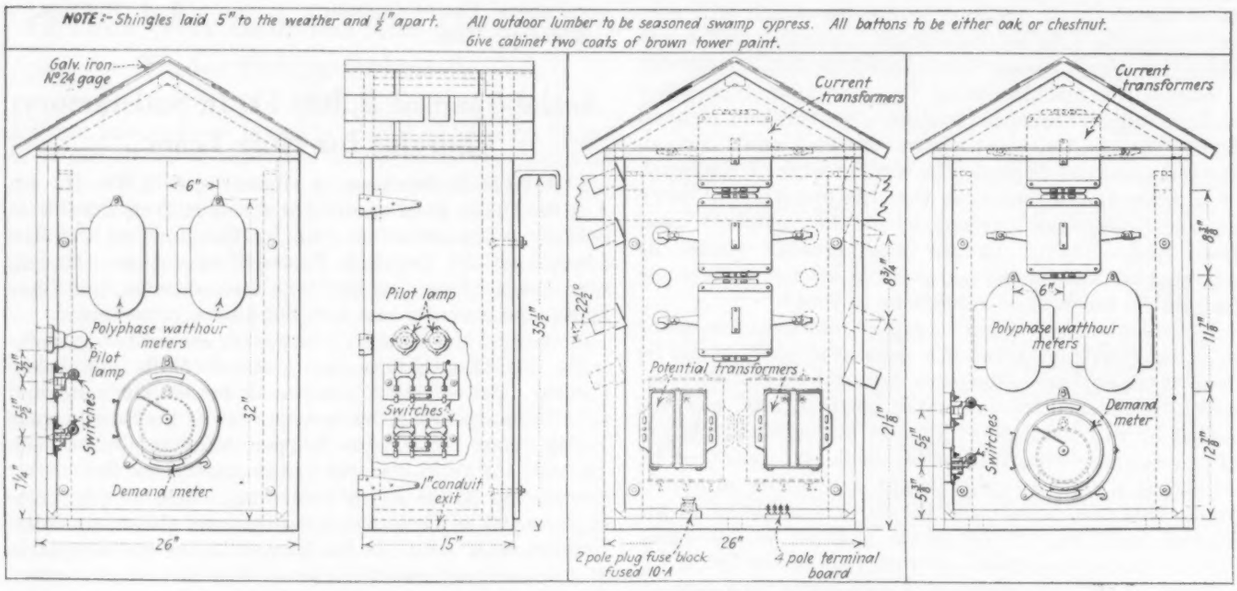



FIG. 1—OUTDOOR METERING EQUIPMENT THAT IS FLEXIBLE, EASILY INSTALLED AND MAINTAINED

Left—Details of meter cabinet and testing facilities. Middle—Instrument-transformer cabinet. Right—220-volt installation, using one cabinet for both meters and transformers

MATERIALS REQUIRED FOR 4,000-2,300-VOLT OUTDOOR METER INSTALLATION

This table accompanies the line foreman's working chart shown in Fig. 2.

| Key No. | Number Required | Materials |
|---|---|---|
| 1 | 7 | Standard six-pin cross-arms comp. "fir" |
| 2 | 13 | ¾-in. x 1¼-in. x 28-in. cross-arm braces |
| 3 | 6 | ¾-in. galvanized machine bolts, length as required |
| 4 | 8 | ¾-in. galvanized D. A. bolts, length as required |
| 5 | 13 | ⅝-in. x 5-in. carriage bolts |
| 6 | 7 | ½-in. x 4-in. galvanized lag bolts |
| 7 | 12 | 2½-in. galvanized square washers |
| 8 | 12 | ½-in. galvanized round washers |
| 9 | 14 | No. 8075 Hubbard & Co. pin or its equivalent |
| 10 | 14 | O. B. 9404 Brown insulator or its equivalent |
| 11 | 7 | O. B. 12464 disk insulator or its equivalent |
| 12 | 14 | O. B. 506 strain insulators for choke coils |
| 13 | 6 | G. E. No. 79219 comp. chamber lightning arrester |
| 14 | 1 | G. E. No. 146187 lightning arrester |
| 15 | 3 | G. E. No. 106918 expulsion cut-out |
| 16 | 2 | Galvanized ground pipe 1¼-in. x 10-in. |
| 17 | .. | Wood molding, length as required |
| 18 | 5 | Galvanized iron pole steps, ⅝-in. x 9-in., hook-head |
| 19 | 7 | L. M. Co. 1741-G galvanized bolt clevis or its equivalent |
| 20 | 7 | O. B. 11546 suspension hook or its equivalent |
| 21 | 7 | O. B. 11545 ball-socket clevis or its equivalent |
| 22 | 7 | ½-in. galvanized thimble |
| 23 | ½ lb. | Eightpenny nails |
| 24 | .. | ¾-in. galvanized pipe straps as required |
| 25 | 2 | L. M. Co. No. 1765-G ground pipe points |
| 26 | .. | No. 2 W. P. wire, lightning arrester and ground as required |
| 27 | 215 ft. | Wire for choke coils, same size as line |
| 28 | .. | Wire for verticals as required, same size as line |

shape and assembled and the cable is also pulled into the conduit. Only three pieces are required on the field job to make a meter installation, namely, a transformer cabinet, a meter cabinet and a length of conduit, standard drawings like that shown in Fig. 2 being followed.

Assembly of the equipment is handled in the following manner: A complete requisition is prepared by the superintendent of distribution. The portion referring to meters and specifying the kilovolt-amperes and voltage, phases of the circuit and the wire that is to be used is turned over to the meter superintendent, who also receives a memorandum from the power salesman, who specifies the rate at which the customer is to be charged and also confirms the kilovolt-amperes, number of phases, wire and voltage.

The bill of material is made out in the accompanying form by the meter superintendent, who then sends the proper wiring diagram, ratios of current and potential transformers and constants of meters to the construction man.

A copy of the bill of material also is sent to the storekeeper and shop foreman in order that there shall be no delays in obtaining the necessary material. Charges for all material used are sent to the meter superintendent, with the authorizations, after the execution of the requisition order. The latter is filed alphabetically or according to the requisition number.

The line foreman, working from prints similar to Fig. 2, notifies the meter department the day on which the pole will be set and ready for mounting of equipment. The meter department wires the equipment in one day and loads it on a truck, ready to start on the job the next morning. It is thus able to complete an installation 30 miles from headquarters in one day, which is only possible because of standardization of equipment and prearranged working plans.

For a 440-volt installation the same equipment is used as for 4,000-volt and 2,200-volt circuits. It has been found that a 110-volt meter and current and potential

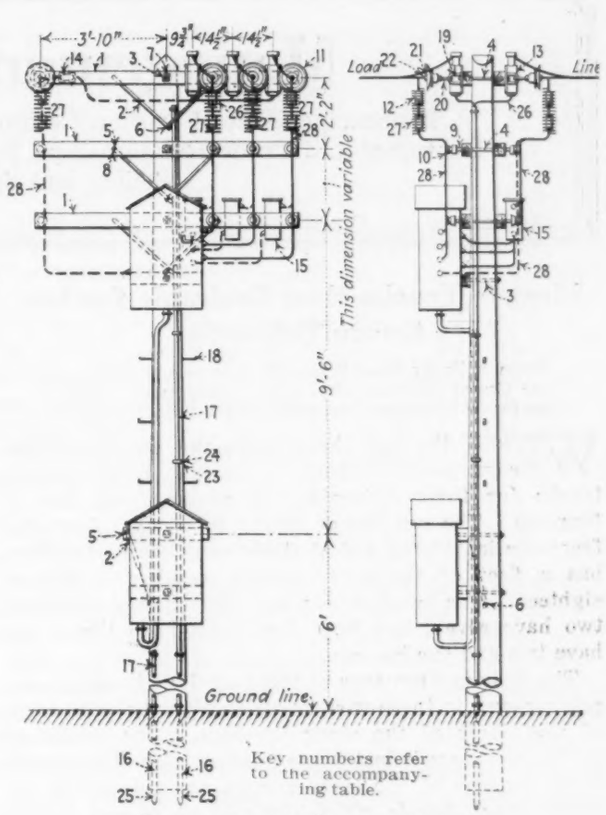



FIG. 2—LINE FOREMAN'S WORKING CHART

transformers give less trouble than a 440-volt self-contained meter. For installations of higher voltage, such as 11,000, 22,000, 33,000 and 66,000, where outdoor equipment is necessary, the apparatus is purchased from manufacturing companies instead of being made locally.

Ohio Power Company, Newark, Ohio.

M. F. SMALLEY, Meter Superintendent.

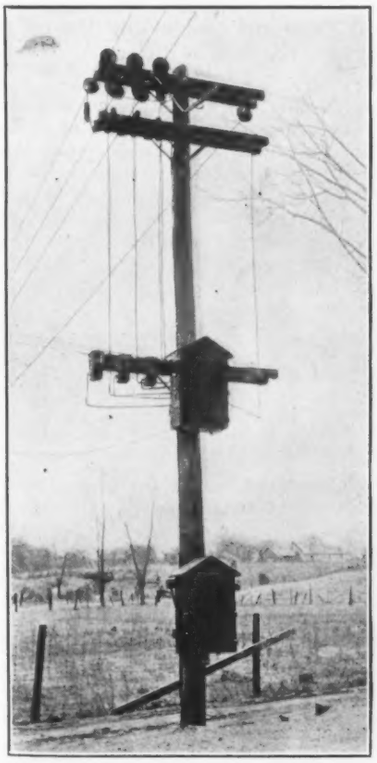
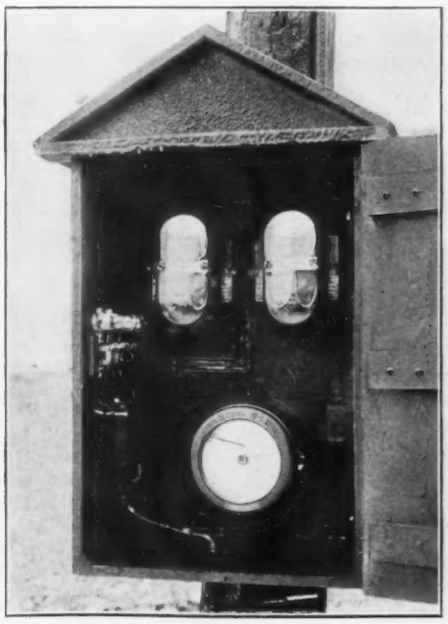


FIG. 3—FRONT AND BACK OF AN OUTDOOR METER INSTALLATION WITH CLOSE-UP VIEW OF METER CABINET



# Management and Policy

**Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods**

## Electric Trucks Most Desirable for Ice-Cream Deliveries

From a Paper Read Before the Illinois Association of Ice Cream Manufacturers by L. T. Carpenter, Transportation Engineer, Commonwealth Edison Company

WITHIN the last three years the number of ice-cream manufacturers in Chicago using electric trucks for their deliveries has grown from four to fourteen. The number of trucks in use has increased from one in 1916 to 106 at the present time. One firm has a fleet of thirty-five trucks, another a fleet of eighteen. One has fourteen, one has ten, one has eight, two have seven, two have four, two have three, two have two and one has one.

The daily performance of many of these trucks is surprising even to those most familiar with the wide range of usefulness of the electric vehicle. The conditions in the ice-cream industry are admirable for the electric truck because of the large energy demand of the ice-cream plant, beside which the cost of energy for the trucks is a small item. The demand for ice cream varies from 400 gal. per day per truck during hot spells to between 100 gal. and 180 gal. per day during the winter. Each truck covers a definite route, and while the ice-cream consumption per customer varies with the months, the mileage traveled daily per truck remains much the same the year round.

The longest route in Chicago is 50 miles; many of them are 45 miles, while the shortest is 10 miles. The average mileage per truck per day ranges from 16 to 30. The average number of customers supplied per truck per day is about thirty-five, the number varying from thirty up to fifty, with the majority around forty-five. At least one manufacturer maintains what is known as a relay system by which diminishing supplies on any truck are replenished without taking that truck off its route. This is done by sending out another larger truck with additional supplies.

### Delivery Costs Halved

The owner of fourteen electric trucks has replaced forty-eight horses and three gas trucks, now using nothing but "electrics." In so doing the delivery cost has been cut in half. Two men do the entire work in connection with the upkeep of this fleet. It has been found that two men can overhaul three electric trucks in the time required to overhaul one 3½-ton gas truck. The former does not require an overhaul oftener than every two years, while the gas truck needs complete overhauling much oftener.

An instance was cited of a department store using twenty electric and fifty gas trucks. While one man takes care of all the work in connection with the electric vehicles, such as charging, minor repairs, flushing and so forth, fourteen men are kept busy keeping the fifty gas trucks on the job. This emphasizes the low upkeep cost and reliability of the electric truck.

Delivering ice cream is the most severe service to which a truck can be subjected outside of road building, because of the severe overloads that occur and the corrosion to which the truck is subjected by the water and salt. Yet some of the electric trucks in this business in Chicago are eight years old, and one is fifteen years old and good for many more years. Corrosion is not a serious matter with the electric truck because the parts are few and can be easily protected. It is estimated that electric trucks in this industry should have a life of from twelve to fifteen years, during which time they will pay for themselves from three to six times out of the savings over other methods of delivery.

The fact that 75 per cent of Chicago's ice-cream manufacturers have already adopted the electric truck and that most of them have already discarded or soon will discard other types of conveyance tells the story that the electric truck is the vehicle for this sort of work in the cities.

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## Preparing Employees to Meet Unfair Criticism of Their Company

TO ENABLE employees of the Edison Electric Illuminating Company of Boston to meet the public confidently and to face unfair criticism without hesitation during the progress of a rate case before the State Department of Public Utilities, L. R. Wallis, superintendent of the sales department, has addressed the following letter to them, emphasizing the return of the company to pre-war rates and contrasting the price of its service with that of other local utilities:

To Fellow Employees:

In presenting to your friends the advantage of electric service as supplied by our company, and in view of some of the unfair statements that have been made regarding increases that were made a part of the cost of service to the public during and following the war period, we should all keep in mind that 90 per cent of the users of Edison service are purchasing their electric requirements at the pre-war price of 10 cents per kilowatt-hour.

Compare this with the following prices:

| | Present Price | Pre-War Price | Per Cent Increase |
|---|---|---|---|
| Boston *American* | 3 cents | 1 cent | 200 |
| Gas—Boston | $1.35 | 80 cents | 68.5 |
| Elevated railway | 10 cents | 5 cents | 100 |
| Railroad fares, per mile | 3 cents | 2 cents | 50 |
| Domestic coal, per ton | $15.25 | $6.25 | 144 |

As our rate case is being tried before the Department of Public Utilities, we have not considered it either good judgment or good taste to enter into a newspaper controversy at this time.

Argument is not productive of sales, but a simple statement and appreciation of essential fact should help you to meet your friends with head up and confident knowledge that "our company" leads the procession in the "return to normalcy."

Boom your business and your interest in your business must boom. Very truly yours, L. R. Wallis,
Superintendent Sales Department.

## Central Stations Should Be Pacemakers in Electrical Merchandising

BY F. M. HOUSTON
Sales Engineer Elmira (N. Y.) Water, Light & Railroad Company

ANY central-station company which now discontinues the sale of appliances and leaves it entirely to others is, I believe, making a mistake which it will pay for in the next few years. The central station should be the one to set the pace and show the contractor-dealers and other merchants the way. While contractor-dealers are often good merchandisers, unless there is some stimulus in the way of friendly competition by the central-station company many are prone to say, "It can't be done." To illustrate, during 1920, although a good buying year, this company did little toward the selling of appliances other than having a few on display. As a result every dealer in town slackened up in his sales efforts. In 1921 we put on a large selling force and went after the selling of appliances in every sense of the word, and every dealer in town did likewise. The result is that at a meeting of the dealers every one reported an increase in the sales over the year before of from 30 per cent to 70 per cent.

We have an agreement here that there shall be no price cutting of any kind, and it is faithfully lived up to by every one. A number of years ago this company was in the housewiring business and gradually dropped out of it. Today the contractors have unanimously requested us to get back in the game again.

I have seen in three different places the experiment tried of the central-station company discontinuing the sale of appliances or having nothing to do with it, not only in the gas but also in the electric end, and in every one of these three places the sales are about one-third of what they should be.

## A House-Warming Party for a New Turbine

THIS picture shows a few of the 4,000 people who visited the power plant of the Southwestern Gas & Electric Company, Shreveport, La., between 5 o'clock in the afternoon and 10:30 p.m. on Feb. 22. The occasion of this house-warming party was the initial putting into service of a new 3,500-kw. turbine. On Feb. 21 the company presented the motion picture film "Back of the Button" and through the daily papers invited the public to visit the plant the next day to see what actually is back of the company's service. Light refreshments were served and there was music and dancing. That the party was a success is attested by the picture and the attendance of 4,000 visitors.

The installation of new equipment in the central station is always a matter of real interest and concern to the public, and the Southwestern Gas & Electric Company has succeeded admirably in arousing this interest. The mere statement that a central-station company has installed a new turbine means nothing to the man on the street, but if he can stand before it and see it work he will appreciate that it is a product of marvelous ingenuity and power.

## What Other Companies Are Doing

**Oregon.**—New business gained by the district offices of the Pacific Power & Light Company during January shows a net increase in new customers of thirty-seven. A total of 155 electric appliances were sold, of which the principal were thirty-two flatirons, sixteen percolators, eleven vacuum cleaners, four electric ranges, three water heaters and nine washing machines. The remainder were made up of miscellaneous appliances.

**Provo, Utah.**—A model "electrical home" was recently completed here, and was open to the public from March 1 to 5 inclusive. On Thursday, March 2, members of the Rocky Mountain Electrical Co-operative League and the Electrical Contractor-Dealers' Association of Salt Lake visited the home. A feature of the program was a luncheon given in their honor.

**Providence, R. I.** — During 1921 the Narragansett Electric Lighting Company in its house wiring campaign wired 2,097 old houses and paid electrical contractors nearly $350,000 for this work. The company secured in that time 7,200 new consumers, most of which were lighting customers. New services installed by the company averaged about fourteen for each working day of the year.

HOUSE-WARMING PARTY IN THE SOUTHWESTERN GAS & ELECTRIC COMPANY'S POWER PLANT

# Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development, the Business and Economic Problems of the Manufacturer, Jobber, Agent, Contractor and Dealer

## Developing the Foreign Market for Electrical Specialties

By R. C. Lanphier
Vice-president and General Manager Sangamo Electric Company, Springfield, Ill.

THE problem of developing and holding a good export business in an electrical specialty for a manufacturer not having the extensive sales organization of the two or three very large manufacturers in the United States is an interesting one and has been approached in different ways by a number of American manufacturers. Many years ago, in 1902 and 1903, we realized the importance of foreign trade in electric meters, although the demand was then exceedingly small compared with what it has since become. At that time our efforts were entirely through agents in England, Japan, France and Australia, and we did not attempt to familiarize ourselves with the agents or with conditions in any of these countries as we would have done had not patent litigation at that time prevented our continuing this development.

R. C. LANPHIER

No effort was made to resume foreign sales to any great extent until 1913, when we began selling on scattered orders from dealers in several countries, including France, Cuba and Japan. When speaking of foreign countries we exclude Canada, which we consider in a large measure as domestic trade.

### Investigation of Foreign Markets

During 1914 and 1915 we sent experienced men on long trips of careful investigation to South America and Europe and thus obtained a first-hand knowledge of the demand for electrical meters in the various countries visited, the best agents available, and the peculiar requirements of every country, that cannot possibly be obtained through any government or trade association reports, no matter how good. We do not mean by this that the government reports and those obtained through different trade associations are not useful, for they certainly are, but in a specialty like electric meters a manufacturer cannot reasonably expect to get complete information, enabling him to develop foreign trade, as he could for general lines such as lamps, motors and electrical supplies. From the beginning we made it a rule in every country to give exclusive representation to a first-class local concern, which we first thoroughly investigated as to business reputation, financial responsibility and technical knowledge of meters. We feel that our policy in this respect was good, as is attested by the fact that we have made only one change in foreign agents in the last five years.

From the beginning we adopted a policy of modifying details of our meters as far as possible to meet the peculiar requirements in many countries, especially in those having government regulations on meters, as is true of the majority of foreign countries. We also made a particular effort to satisfy our customers on details of packing, methods of handling shipping documents, drafts, and in general all details which affected the facility and convenience with which our agent in each country could do business both for himself and his customers.

### Consigned Stocks Essential

After the first two or three years of these efforts we found it desirable to carry a consigned stock at many foreign points in order to make prompt deliveries. This is one of the most essential things in developing foreign business in an electrical specialty, and we have since carried adequate stocks in a number of foreign cities.

During the early part of the war we made sales arrangements in Japan with a well-known Japanese company whose president spent some time with us, and following this we sent one of our officials to Japan for a thorough investigation of the possibilities there and then to visit all the principal countries of the Orient. At the same time we sent other officials to Europe, with the result that we established branch factories with our Japanese representative at Osaka and later with our English representatives near London. At each of these branches we have endeavored to make our product conform in all respects to local requirements and conditions, and except for the men in charge sent from our factory, employ local labor throughout. During the past year adverse exchange has made it difficult to maintain satisfactory business in European countries, but with improving exchange and with the development of types of meters especially to meet foreign competition we anticipate a decided improvement before long.

Summing up, we feel that any manufacturer of detail electrical apparatus, particularly that of a technical nature, should carefully investigate, by means of representatives thoroughly familiar with his line, the possibilities in each foreign country where he desires to do business, or, if this is not possible, the best alternative is to join with one or more other manufacturers of electrical lines which work in sufficiently well with his own to permit of sending a joint representative to investigate conditions and form agency arrangements in the various countries visited. The Orient and South America at this time present the greatest possibilities for many electrical manufacturers and can be developed for many American electrical devices that are now being sold only in limited quantities, if at all.

## The Cost of Doing Business at Retail

ONE of the most universal problems which confront the electrical industry today is caused by the lack of information on the cost of selling, the cost of doing business at retail. It affects not only the retail dealer, but the manufacturer and jobber as well, for prices and discounts must be adjusted to allow a margin sufficient to cover selling cost and show a net profit. Data showing the operating expenses or selling costs for department stores and other retail businesses are therefore particularly useful for comparative purposes.

In a recent report by the Harvard Bureau of Business Research figures showing the highest, lowest and common, or average, operating expenses in retail hardware stores are given in the accompanying table, in which total expense represents the cost of doing business. It includes all items of wages, payments for items such as postage, heat, light and taxes and insurance and also the salary of the proprietor, rent whether the store is owned or leased, and interest on borrowed capital and on the proprietor's net investment.

In a survey made by J. M. Barnes of Marshall Field & Company further information and data have been developed indicating what may be considered a fair cost of doing business at retail in towns and cities of different sizes, with some indication as to how this cost increases with the population. He says:

If we consider towns having a population of less than 2,500, we will find that the cost of doing business usually runs from 15 to 20 per cent of sales. An average of about 18 per cent would appear to be normal for such towns. When we consider larger towns, having a population of from 2,500 to 10,000, we find that the cost of doing business usually runs from 18 to 23 per cent of sales. A fair average would be about 21 per cent. In cities having a population of from 10,000 to 50,000 we are apt to find that the cost of doing business has again increased and that it amounts to from 20 to 25 per cent of sales. An average would probably be about 23 per cent. In cities having a population in excess of 50,000, the cost of doing business has a further tendency to increase. Here it usually runs from 23 to 28 per cent. About 25 per cent of sales would be an average.

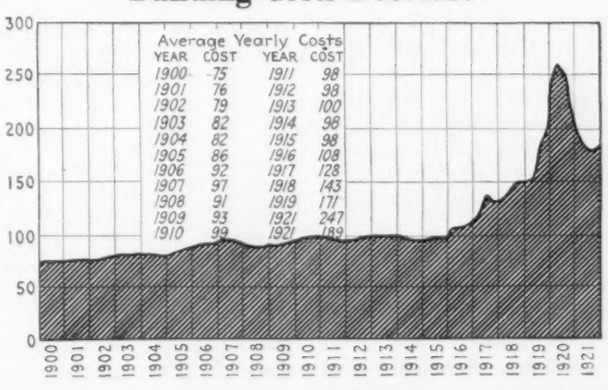
There are some unusual exceptions to the above figures. There are some merchants in small towns who do business at a cost of not more than 10 per cent of sales. There are other merchants in cities who do business at an even greater expense than 28 per cent. Such cases are abnormal. What we desire to know for purpose of comparison is the average expense of the successful merchant and not the unusual expense of the exceptional merchant. Having these figures in mind, every merchant should carefully scrutinize each item of his expense account. If he finds that his expenses do not exceed the above average, he may feel assured that he is on a competitive basis. But if he finds that his expenses are much in excess of the average mentioned above, he may feel certain that he is operating at a disadvantage and possibly at a loss.

While conditions in the electrical industry do not exactly parallel those in either the department or hardware stores, electrical dealers, jobbers and manufacturers may well compare their figures to see how close the costs run to those of other successful merchants.

OPERATING EXPENSE IN RETAIL HARDWARE STORES IN 1919
(Net Sales 100 per cent)

| | Percentage | | |
|---|---|---|---|
| | Lowest | Highest | Common |
| Wages of sales force | 2.57 | 15.8 | 6.2 |
| Other selling expense | 0.03 | 4.12 | 0.7 |
| Total selling expense | 3.02 | 15.8 | 7.0 |
| Delivery expense | ..... | 3.22 | 0.7 |
| Buying, management and office salaries | 0.66 | 9.64 | 4.0 |
| Office, supplies, postage and other management expenses | 0.08 | 1.87 | 0.3 |
| Total buying and management expense | 1.15 | 10.6 | 4.4 |
| Rent | 0.38 | 6.09 | 1.7 |
| Heat, light and power | 0.06 | 1.35 | 0.4 |
| Taxes (except on building, income and profits) | 0.04 | 1.14 | 0.5 |
| Insurance (except on building) | 0.08 | 1.02 | 0.4 |
| Repairs of store equipment | 0.01 | 1.11 | 0.1 |
| Depreciation of store equipment | 0.02 | 1.6 | 0.3 |
| Total interest | 0.95 | 8.95 | 3.3 |
| Total fixed charges and upkeep expense | 3.07 | 12.68 | 7.0 |
| Miscellaneous expenses | 0.01 | 3.86 | .9 |
| Losses from bad debts | ..... | 6.8 | 0.5 |
| Total expense | 11.42 | 36.3 | 21.0 |

## Building Costs Decrease




EVERY new building that is started means more business for the manufacturer, the jobber and the dealer and nothing will quicken building like decreasing costs. This chart pictures the marked decline in prices of construction material. It is worthy of a bit of thought.

## Making Imitation Jobbers Out of Screwdriver Electricians

ANOTHER sidelight on how easy it has been made by some manufacturers for mushroom jobbers to spring up in the electrical trade is seen in this letter from a branch office manager to the general sales manager of one of the largest electrical manufacturers. The names and location have been deleted, but the letter points only too clearly to a condition which is menacing the distribution of electrical supplies. The letter reads:

GENERAL SALES MANAGER:

The establishment of new jobbing concerns in the surrounding territory still continues, and every large community will soon have at least one and in some cases three jobbers to look after local service. Many of these concerns appear to be able to start in with very little capital, and in most cases they have affiliated with standard lines. One of the worst cases is that of ——— in ———, who has been placed on the distributers' list by the ——— Manufacturing Company and several other manufacturers. The interesting part is that ——— is a village of 2,500 people and has no special advantages as a distributing center—in fact, quite the contrary, as some of the regular trains on the only railroad passing through do not even stop.

I understand that the ——— Lamp Company is also considering putting him on a jobber basis, although he has had an agent's contract for the past two years and never exceeded $1,200 per year. Don't you think that there should be some restriction as to the appointment of jobbers who have never done anything to show that they can get business?

DISTRICT MANAGER.

This is, unfortunately, not an exceptional case but is only one of many which could be cited. It represents a situation which is not only uneconomical but will ultimately, if the practice is not stopped, undermine and create chaos throughout the whole system of distributing electrical supplies.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

## Generators, Motors and Transformers

*Single-Phase and Three-Phase Alternating-Current Commutator Motors with Series and Shunt Characteristics.*—STANLEY PARKER SMITH.—The author deals with the electrical and mechanical characteristics of the motors of this type. These machines possess certain practical difficulties from both the designer's and the manufacturer's point of view. Though they were invented some years ago, their commercial development has been slow, but recent demands for alternating-current motors have led to their possibilities being further considered.—*Electrician (London)*, Jan. 13, 1922.

*The Problem of the Most Economic Transformer.*—J. HAK.—A purely theoretical paper in which a general equation for the efficiency of a transformer is developed. By its aid the most favorable dimensions for a given transformer and the losses in iron and copper can be determined. The difference is shown between the least expensive and the most economical design.—*Elektrotechnische Zeitschrift*, Jan. 26, 1922.

*Three-Phase Generators with Vertical Shaft.*—G. LEWINNECK.—The great shortage of coal and the abundance of low-head water power in Germany and Sweden were responsible for the recent installation of a number of remarkable low-speed, vertical-type generators. This paper describes three of these—a 1,050-kva., 58-r.p.m. generator; a 1,300-kva., 83-r.p.m. generator and a 6,500-kva., 83-r.p.m. machine. The latter, as far as bulk is concerned, is one of the largest vertical-shaft machines in existence. It is 23 ft. (6.9 m.) in diameter and stands 17 ft. (5.1 m.) above the floor of the operating room. All stator coils are machine-wound and embedded to make them short-circuit-proof. The rotor construction is designed for 80 per cent overspeed. There is no exciter on the shaft.—*A. E. G. Mitteilungen*, January, 1922.

## Lamps and Lighting

*Lighting of the Clothing Industry.*—A. B. ODAY and R. W. PEDEN.—A discussion of the present practice of lighting in clothing factories. The requirements as regards location and intensity of light are given for machine sewing, hand sewing, cutting, knitting, inspecting and folding, fitting, pressing, laundering, stockroom, sample room and showroom, and for packing and shipping.—*Bulletin L. D. 133 of the Edison Lamp Works.*

*Interlaboratory Photometric Comparisons of Gas-Filled Tungsten Lamps.*—W. E. FORSYTHE and F. E. CADY.—Reports of comparative photometric tests of incandescent lamps have been made to the Illuminating Engineering Society on several occasions, and in order that such information should be as complete as possible, it was thought that it might be helpful to have a set of measurements made by the authors duplicated in other laboratories. The bodies co-operating in such a test were the research section and testing section of the National Lamp Works, the Westinghouse Lamp Company, the Electrical Testing Laboratories, the Edison Lamp Works, the Nela Research Laboratories and the Bureau of Standards.—*Transactions of the I. E. S.*, Dec. 30, 1921.

## Generation, Transmission and Distribution

*Economies of Very High Steam-Pressure Plants.*—WILHELM SCHMIDT.—For the last forty years the author has experimented with the commercial possibilities of using steam pressures as high as 60 atmospheres (875 lb.) and a steam super-temperature up to 400 deg. C. A boiler with a firing surface of 1.42 sq.m. and a heating surface of 72 sq.m. was built recently, producing 1,340 kg. of steam per hour at 60 atmospheres pressure. This boiler has given perfect service for 14,500 firing hours. Several firms have built reciprocating engines to be operated from this boiler. In general the advantage of such high pressure will be considerably smaller floor space and weight for the same efficiency. For example, a 4,000-hp. engine will weigh about 50 tons for 60 atmospheres and 188 tons for 15 atmospheres. —*Elektrotechnische Zeitschrift*, Jan. 12, 1922.

*Developments in Power-Station Design.* — Another article of a series, this one dealing with water-tube boilers.—*Engineer (London)*, Jan. 13, 1922.

*Hydro-Electric Developments Near Bathurst, N. B.*—JAMES DICK.—Construction details are given of the new hydro-electric plant of the Bathurst Company, Ltd., at Grand Falls, on the Nepisiguit River, in the Canadian province of New Brunswick. This plant is to have a capacity of 13,500 hp. and operate under a head of 100 ft. and a generating potential of 4,400 volts. For transmission 33,000 volts will be used.—*Canadian Engineer*, Jan. 31, 1922.

*Overhead Lines for Medium Voltage.*—E. GUIGNARD. —With the aid of an actual example the author investigates the comparative advantages of a three-phase line installed on wooden poles and the same line on reinforced-concrete poles. For both cases a straight right-of-way and an irregular right-of-way are considered. Assuming an amortization at 7 per cent for fifty years, the author comes to this conclusion: (1) For irregular lines of small medium copper cross-section the choice of wooden poles is more economical, resulting in a saving of 170 francs per kilometer-year; (2) for straight lines the use of cement poles is a decided advantage, saving 67 francs per kilometer-year as compared with wooden poles.—*Revue Industrielle*, January, 1922.

## Traction

*Passenger Locomotives for Chilean State Railways.*—Features in design of the passenger locomotives for the Chilean State Railways electrification on the Santiago-Valparaiso-Los Andes section are discussed. The experience with the St. Paul and Paulista locomotives was utilized in the selection of these locomotives. One of the features pointed out is the interchangeability of parts, permitting the carrying of a small stock of renewable parts, which facilitates the maintenance of locomotives

and keeps down the maintenance cost. A description is given of the local and express passenger locomotives, which are supplied with regenerative braking equipment.—*Electric Railway Journal*, Feb. 25, 1922.

*Electrification of the St. Gotthard Railway.*—The actual equipment of the railway that runs from Lucerne to Chialso on the Swiss-Italian frontier is described. Two hydro-electric generating stations, one at Amsteg and the other at Riton, supply energy at 60,000 volts for transmission. This is reduced to 15,000 for trolley use. The locomotives are manufactured by the Oerlikon company.—*Engineer (London)*, Jan. 20, 1922.

### Installations, Systems and Appliances

*Electric Power Application to Passenger and Freight Elevators.*—HARRISON P. REED.—Report of the subcommittee on elevators of the industrial and domestic power committee of the American Institute of Electrical Engineers on the application of electric power to passenger and freight elevators. An enormous amount of electrical energy is used for the operation of elevators, and the problem should be studied from a power economy standpoint as well as from the standpoint of protection to life. The subjects taken up are: (a) History and service requirements; (b) types of elevator machines and the limitation of each; (c) characteristics and limitations of direct-current and alternating-current motors; (d) elevator controllers; (e) brakes and other safety accessories; (f) power consumption.—*Journal of the A. I. E. E.*, January and February, 1922.

*Plant Production Organized Around a Material-Handling Plan.*—This article gives the details of the transportation system and production program in the South Bend (Ind.) works of the Studebaker Corporation of America. In this plant storage-battery tractors are used with an assortment of trailers, some of standard design built for general use, others designed for specific purposes. These comprise a vital part of the entire transportation plan around which the plant production is organized.—*Electrical Review and Industrial Engineer*, February, 1922.

### Electrophysics and Magnetism

*Characteristic Soft X-Rays from Arcs in Gases and Vapors.*—F. L. MOHLER and PAUL D. FOOTE.—Potentials required to excite successive types of radiation in a low-pressure Wehnelt arc were measured by observing the photo-electric effect of the arc radiation on other electrodes within the same tube. Critical radiating potentials for eleven gases and vapors were measured in a range from 17 volts to 500 volts. The corresponding limiting spectral frequencies include the softest characteristic X-rays for all the elements considered. Experiments with radiation from solids indicate the existence of soft characteristic X-radiation, with no measurable general radiation under the best vacuum conditions.—*Scientific Papers of Bureau of Standards, No. 425.*

*Dynamic Methods of Determining Triode Valve Constants.*—HIDETSUGU YAGI.—A discussion of the operational constants of triode valves such as the amplification constant, the mutual conductance and the internal impedance. The author in the determination of these constants used two methods, both at radio frequency. These methods were developed by Dr. J. M. Miller and Stuart Ballantine.—*Technology Reports of Tohoku Imperial University*, Vol. 2, No. 3.

### Electrochemistry and Batteries

*Roasting Zinc Ores for Electrolytic Reduction.*—THOMAS FRENCH.—The object of this article is to suggest various means by which the methods of roasting may be so modified as to give increased extractions. Some of the suggested alterations are quite different from the present recognized practice, but the results obtained are satisfactory. Quick roasting with thin beds is advised. When ores containing a minor percentage of lead are treated with ground coal, there is little danger of the lead separating in the metallic state.—*Engineering and Mining Journal*, Feb. 18, 1922.

*Overhauling Storage Batteries*—CHESTER SCHENCK.—In spite of the best care that can be given it, a storage battery must be overhauled sooner or later. In this article the author summarizes the symptoms that give warning of the need of overhauling. He gives the preparation necessary to carry on the work, with explicit directions covering two methods of procedure, one to be used when the work is carried to completion and the other where interruption is probable.—*Power*, Feb. 28, 1922.

### Telegraphy, Telephony and Signals

*Radio Calling Apparatus.*—L. CHAUVEAU.—To Compete with ordinary wire telephony and telegraphy, it was necessary to develop some simple and reliable system whereby a radio operator might call a certain person or station. The author claims to have solved this problem and gives a description of his automatic radio calling apparatus. It consists of a combination of twenty magnetic relays—ten responding to "dot" and ten to "dash" calls—and a time relay. The apparatus can be set for any combination up to five letters or numerals, and if the call arrives in proper sequence and at proper time intervals, the last relay will close a signaling circuit, notifying the attendant of the receiving station. To insure the essential accuracy of sequence and time, the sending station emits the call with a mechanical caller.—*Radioelectricité*, January, 1922.

*Telephone Line Work in the United States.*—E. S. BYNG.—This paper was read before the British Institution of Electrical Engineers and contains observations made by the author on telephone-line construction during a trip to the United States.—*Journal of the Institution of (British) Electrical Engineers*, January, 1922.

### Miscellaneous

*Effect of Moisture Content Upon the Expansion and Contraction of Plain and Reinforced Concrete.*—TORATA MATSUMOTO.—Investigations of the effect of moisture on the appearance and durability of concrete. Some of the conclusions reached were: (1) Concrete expands when it absorbs moisture and contracts when it is dried. (2) Contraction of concrete by the loss of moisture causes stress in the concrete when it is restrained by an external force. (3) The shrinkage stress caused in the steel in reinforced concrete may reach the usually accepted working stress of steel when the amount of reinforcement is less than 1.5 per cent. (4) The greater the percentage of reinforcement, the greater the tensile strength that may be developed in the concrete. (5) In reinforced concrete out of doors, subject to alternate wet and dry conditions, cracks may readily be formed under the repeated stress. This may be prevented by finding a cement giving less expansion and contraction, or by the use of a waterproofing treatment.—*University of Illinois Bulletin, No. 126.*

# Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

*Conducted by* PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

## Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CIRCUIT-BREAKERS, OIL, TESTS ON.

Numerous tests have been lately made on large-capacity oil circuit breakers, prominent manufacturers and operating companies co-operating in these tests. The purpose of the tests was to ascertain the actual rupturing capacity of the breakers since the manufacturers do not have sufficient generating capacity in their factories. The tests proved to be of considerable interest and caused but little disturbance in transmission and distributing networks.—*N. L. Pollard, Public Service Electric Company, Newark, N. J.*

ELECTROSCOPE FOR DETECTING HIGH POTENTIALS IN CABLES.

An aluminum-vane electroscope has been developed, with the vane pivoted slightly above its center of gravity and the supporting frame mounted on hard rubber. A ring of the lead sheath about 4 in. wide is removed from the cable to be cut and the electroscope is held near the exposed insulation. If the cable is alive, the vane will be attracted to it. At 500 volts the attraction is easily noticeable, and at 1,000 volts it is vigorous. The instrument works satisfactorily under almost any weather conditions and in damp manholes where the gold-leaf type will not work.—*W. J. McIlvane, United Electric Light & Power Company, New York, N. Y.*

TIMING INSTRUMENT.

A process timing and signaling instrument has been developed which has no clock mechanism. It consists of a small self-starting synchronous motor connected to a 60-cycle source of supply. The dial is calibrated directly in minutes and seconds of time. It can be set for a desired length of time and automatically rings the bell or lights a lamp at the expiration of this time interval. Pushing a button resets it, and pushing another button starts it for another similar interval of time.—*Stromberg Electric Company, Chicago, Ill.*

CURRENT TRANSFORMERS, SHORT-CIRCUIT-PROOF.

It has been reported from Germany that current transformers have been developed which can stand tremendous transient short-circuit currents without mechanical or thermal damage (*Elektrotechnische Zeitschrift*, Vol. 42, page 905). Such transformers are sometimes made with two cores—an iron core with a winding to which the measuring instrument is connected, and a second core, of smaller cross-section, with a winding for connecting the overload relay. The second core is so made that the secondary current rises at a much slower rate than the primary. By this means the violent mechanical shock to the relay mechanism is avoided and the burning out of the relay winding is rendered impossible.

HEATING, ELECTRIC, OF RESIDENCES.

An investigation has been completed of the actual use of electrical energy for heating residences in the Western States, and computations have been made as to its cost, energy consumption, conditions under which it can compete with coal, etc. The results have been published in full in a University bulletin. —*E. A. Loew, University of Washington, Seattle, Wash.*

BATTERIES, STORAGE, RESISTANCE OF SEPARATOR PLATES.

Soft woods, such as poplar and basswood, have the lowest resistance. Cedar and cypress, on the other hand, have considerably higher resistance, but are known to have better lasting qualities when used in storage batteries. A number of samples have been cut to a specified size and immersed in an acid solution of known concentration. One set is being kept at room temperature and a similar set at 45 deg. C. At the end of periods of one month, three months and six months samples will be withdrawn to determine the decrease in tensile strength. —*Bureau of Standards, Washington, D. C.*

TELEPHONE RECEIVERS, RADIO, CRITICAL FREQUENCY OF.

On account of the distributed capacity between the windings of telephone receivers and between the closely spaced leads used with them there is a critical frequency at which the resistance is a maximum. Just below this critical frequency there is a sharp maximum of inductive reactance, and just above a sharp maximum of capacitive reactance. Measurements have been made on commercial types of radio head sets, and the critical frequency has been found to vary between 8,000 cycles and 60,000 cycles, with maximum values of resistance and reactance of the order of 100,000 ohms.—*Radio Laboratory, Bureau of Standards, Washington, D. C.*

RADIO CIRCUITS, POWER FACTOR OF.

In order to measure the phase angle between the sinusoidal currents in two radio circuits a third circuit is used in which the induced current is measured thermally. This tertiary circuit is successively subjected to the influence of each radio circuit separately, and then of the two simultaneously. This gives the values of the two currents and of their vector sum. From the vector triangle so obtained the phase angle can be determined. — *N. H. Williams, University of Michigan, Ann Arbor, Mich.*

CORONA, THE VIBRATION OF WIRES DUE TO.

The vibration of wires carrying a sufficiently high potential to show the corona has been reported by a number of observers. This effect takes place with both direct-current and alternating-current corona. In view of the close relation between the electric wind, the corona pressure and this type of vibration, the conditions for its production have been studied experimentally. Thus far these studies have been confined to the case of an alternating potential between parallel wires, and the results will be published later.—*Charles S. Fazel, Department of Physics, University of Illinois, Urbana.*

MAGNETS, PERMANENT, RAPID AGING PROCESS FOR.

It has been found that a partial demagnetization of a magnet previously brought to saturation gives nearly the same effect as aging, either with time or by the use of boiling water. If the preliminary tests are substantiated by a more extensive study, the time of maturing a magnet may be considerably reduced. (See *Electrician*, Vol. 87, 1921, p. 263.

## Suggestions for Research

DIELECTRIC LOSSES.

Analysis of dielectric losses is greatly needed, with a view to the determination of process specifications for the manufacture of dielectrics and with a view to the determination of dielectric constants which may be depended upon in the design of dielectrics.—*Prof. Harold B. Smith, Worcester Polytechnic Institute, Worcester, Mass.*

ALTERNATORS, EDDY CURRENTS IN ARMATURE CONDUCTORS.

When large conductors are subdivided to reduce eddy-current losses, the main current is divided unequally among the parallel circuits, owing to their different inductance. Besides the usual remedy of transposition and extra iron on end connections, Dr. Lehmann (*Revue Générale de l'Electricité*, Vol. 9, 1921, p. 915) proposes the two following remedies: (a) To provide the armature teeth with long, inclined incisions; (b) to envelop the different bars with iron sheaths so as to equalize their self-inductions. Further experiments in this direction are desired.

TURBO-GENERATOR FIRES DUE TO DIRT AND STATIC.

Some tests have been made by D. D. Higgins on the inflammability of dirt on armature windings under the influence of static sparks and of overheated conductors. More systematic and thoroughgoing researches in the same direction are desired with a view to devising practical means for removing such dirt or making it harmless.

FUSE METAL.

To what is the change in carrying capacity of fuse ribbon with service due, and can a more permanent alloy be found for this purpose?—*M. G. Lloyd, Bureau of Standards, Washington, D. C.*

INDUCTION MOTOR, MAXIMUM INPUT AND MAXIMUM POWER FACTOR.

Usually the circle diagram is determined by the no-load and short-circuit points. The latter point cannot be determined very accurately, and there are inaccuracies in the theory which make the use of the short-circuit test somewhat undesirable. It is proposed to supplement the test by obtaining the values of maximum power factor and of maximum input. The polyphase wattmeter and the power-factor meter in the primary circuit can be watched, either when the motor is running up to speed or when it is pulling out of step, and the maximum indications noted. This will give the maximum ordinate of the circle and a tangent to the circle from the origin. The short-circuit point can be used as a check. It is desired to verify this proposal experimentally.

PROTECTION AGAINST PHASE FAILURE.

When a three-phase induction motor is running and one of the line conductors becomes accidentally opened, the motor continues to run single-phase unless the load is sufficiently heavy to actuate an over-load device. Unfortunately, overload devices are often set too high for such a purpose. An under-voltage relay will not operate either, because the revolving magnetic flux induces virtually a full-line voltage in the dead phase. A simple and reliable protection is desired for such an emergency, a device that would at least call the operator's attention to the trouble, if not stop the motor.

GEARS, PITTING OF.

In power units employing gear drive it has been noticed that the gearteeth are subject to a decided pitting or erosion along the line of maximum tooth pressure. From the results of preliminary investigation it would seem that this pitting is due to the oxidizing action of air in the oil film which is entrapped at high pressure between the teeth. Further investigation is desired as to the cause and possible remedies for gear pitting.—*N. E. L. A. Prime Movers Committee.*

OIL, INSULATING, ESTIMATION OF WATER IN.

The proposed method is based upon the evaporation of the water by passing a current of dry air through the moderately heated oil, and then, by active refrigeration of the air, condensing the aqueous and other vapors which it carries. It would be of interest to develop a simple practical device for testing oil on this principle.—*Comptes Rendus*, Vol. 173, 1921, p. 311.

# News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

## Possibility of Delay in Muscle Shoals Settlement

THERE is a growing feeling in Washington that the tangle over Muscle Shoals may not be unraveled for some time. The proposal of Chairman Kahn of the House committee on military affairs to refer the proposition to a commission consisting of the Secretaries of the Treasury, War and Agriculture, if carried into effect, might mean delay, as the Cabinet officers are already overburdened with work. Since it seems probable that Mr. Kahn has sufficient support within his committee to dominate its action on the Muscle Shoals matter, it is believed that his attitude means at least that no recommendation as to legislation will be made at this time.

As the analysis of Mr. Ford's offer proceeds it is becoming more and more apparent that Mr. Ford's opportunity to earn unusual profits is great. One nationally known engineer remarked that Mr. Ford's earnings would entirely overshadow the rate of profit made on the most flagrant cost-plus war contract. He said the offer is unfair in that it gives Mr. Ford an undue advantage over other industrial concerns, since the United States would pay fully 50 per cent of his power cost.

## Recommendations for Government Radio Control

TENTATIVE recommendations as to methods and policies for radio-telephone control have just been issued by the technical committee of the radio-control conference called by Secretary Hoover. A meeting will be called in a week or two to consider such constructive criticisms as may be made.

The recommendations, which are of great length and detail, point out the necessity for government control of radio telephones as the only solution to the present chaos of interference. The committee therefore recommends that the existing powers of the Department of Commerce be extended to complete control of transmitting stations. It does not recommend any control of receiving stations. The committee recommends that wave lengths below 6,000 m. should in a general way be reserved for radio-telephone service, but that those wave lengths which have become fixed in service for telegraph service within this range, such as S O S signals, shall be retained.

The committee considers that the present development of the art warrants the separation of twenty different wave bands within this range, of which seventeen lie between zero and 2,000 m. In the assignment of these wave bands the committee recommends that priority first be given to broadcasting service and that, secondarily, broadcasting service itself should be divided into priorities in the following rotation: First, government broadcasting; second, educational and public broadcasting; third, private broadcasting, including entertainment, news, etc., and fourth, toll broadcasting.

Reservation of wave lengths between 150 m. and 275 m. is made for amateurs, and some opportunity in experimental wave lengths would be assigned to them in addition. The committee says that, in addition to the establishment of wave bands for different services in various priorities, it is also necessary to limit the amount of power used in transmitting stations, thus limiting each of them to some special zone in order further to limit interferences and enable a wider variety of wave lengths to be assigned to different localities. The committee also recommends that the selection of the time of day to be occupied by different transmitting stations for different services should be controlled.

## Report of Joint Committee on Inductive Interference

THE joint general committee of the National Electric Light Association and the Bell Telephone System is sending out the report of its sub-committee, which is recommended as a basis for the handling of the inductive-interference problem between electric light and power companies and telephone companies. A sub-committee, consisting of M. R. Burt, R. F. Pack and Bancroft Gherardi, has been instructed to proceed with the further work as recommended under the section devoted to standards of construction and operation and to report before May 15.

The general committee as soon as standards of construction and operation are adopted will consider whether principles can be established to aid in the fair allocation of the costs of co-ordinate measures. In the meantime, the committee believes that with the co-operative spirit which now is evident a mutually equitable adjustment can and should be made in each specific case. It is understood that any adjustments made will not be considered as precedents by either party to the prejudice of future understandings.

The sub-committee report, which is signed by R. F. Pack representing the N. E. L. A., and Bancroft Gherardi, representing the Bell Telephone System, follows:

A committee of engineers was brought together consisting of H. P. Carlesworth, S. P. Grace, H. S. Osborne and H. S. Warren for the Bell Telephone System and W. J. Canada, A. E. Silver and F. H. Lane for the National Electric Light Association. This group of engineers proceeded, under our direction, to hold a series of meetings (in conformity with a memorandum prepared by us and attached hereto) for the purpose of (1) analyzing the situation to determine the extent to which standards of practice and construction exist which are mutually acceptable, and (2) setting forth certain principles of procedure for the treatment of those situations of proximity for which such standards have not been mutually acceptable.

In accordance with your instructions the question of allocation of cost of co-ordinative measures has not been discussed.

Your sub-committee has gone over the results of this work carefully and now presents this initial report outlining certain recommended principles and standards. These apply generally to future construction but may be employed as occasion requires in clearing up existing situations.

As an essential step in promoting conformity with these recommended standards and principles, an arrangement should be set up between the respective utilities providing for the interchange of pertinent data and information relative to proposed and existing construction and changes in operating conditions concerned in situations of proximity.

*Classification of Situations of Proximity.*—Existing standards acceptable to both utilities are available covering the situations arising out of crossings, conflicting construction and jointly occupied poles. As to the question of parallel construction, standards acceptable to both utilities are not yet available but certain general principles of procedure have been agreed upon and a program is recommended with a view to the early development of mutually satisfactory standards.

*Crossings.*—The National Electrical Safety Code provides an acceptable guide to practice.

*Conflicts.*—By "conflicts" are meant situations where two separate pole lines parallel each other in close proximity under conditions more specifically defined in the National Electrical Safety Code. The National Electrical Safety Code provides an acceptable guide to practice. The safety code does not include the subject of inductive interference in its scope. As far as inductive co-ordination of circuits is concerned, the principles recommended below under "Parallel Construction Generally" may be considered as applying to "Conflicts" and "Jointly Occupied Poles."

*Jointly Occupied Poles.*—There are very substantial advantages to both utilities in the employment of jointly occupied poles where the conditions and character of the circuits permit. The joint use of poles by supply and signal circuits is generally preferable to separate lines when justified by considerations of safety, economy and convenience and presuming satisfactory agreement between the parties concerned as to terms and conditions. The preferences and construction requirements of the National Electrical Safety Code for joint use between supply and signal circuits are tentatively accepted. In order to reach a final understanding, particularly with regard to the question of joint use involving certain types of circuits, your committee finds that further consideration is necessary.

*Parallel Construction Generally.*—The problem of inductive interference requires the combined consideration of both power and communication utilities because it arises from contributing characteristics of both systems and their physical relations. The situations encountered include parallel lines, whether on separate or jointly used poles.

In approaching the solution of this problem it is recognized that the public interest is paramount and that the power and communication utilities must be able to render service to the public in an economical and efficient manner, and that for this purpose both have been granted rights to use highways, and that they must utilize the highways to serve their customers properly with plants so laid out as to be readily accessible and easily operated and maintained.

The power utilities, thoroughly recognizing the desirability of co-ordination, state that as necessity requires and in order to serve their customers they have the right and the duty to the public to place an electric light or power line of any type on a highway, provided that the location and type of construction are such as reasonably to co-ordinate with similarly co-ordinated lines owned or operated by the communication utilities, and that they cannot be restricted from serving their customers in a reasonably economical and satisfactory manner because of the presence of communication circuits on the highways involved.

The communication utilities, thoroughly recognizing the desirability of co-ordination, state as their position that it is their right to have their service, when rendered over properly constructed lines, free from impairment caused by either (1) subsequently constructed parallel supply lines or (2) existing supply lines by reason of subsequent changes in such lines or their operation, including in either case, as far as practicable, impairment caused by transient operating conditions on such supply lines. In cases of parallel construction on highways such that impairment cannot be avoided at the proposed separation by available co-ordinative measures the communication utilities believe they not only have the right but it is their duty to the telephone-using public to require that some plan, including separation adequate to prevent impairment, be employed.

While neither party hereto subscribes to the statement of position of the other party or relinquishes any of the rights claimed by it, the desire of both parties is to co-operate for the purpose of avoiding controversies which might arise out of their differences as to their relative rights, and we, therefore, recommend that they proceed along the following general plan, which plan it is confidently believed will enable both parties to meet their service requirements in a satisfactory manner and at the same time leave unimpaired all of the rights claimed by either party.

### RECOMMENDED PLAN FOR THE SOLUTION OF INDUCTIVE-INTERFERENCE SITUATIONS

*I. General Principles:*

A. Co-operative planning for all new construction.

B. The location, construction and operation of all supply and signal circuits in conformity with generally co-ordinated methods, including precautionary measures which can reasonably be applied under generally prevailing conditions as distinguished from special situations.

C. Where specific co-ordinative measures are necessary, those providing the best engineering solution should be applied. This involves: (1) Meeting service requirements of both systems; (2) the co-ordinative measures applied shall be selected without regard to whether they apply to one system or the other system or both; (3) the solution to be based as far as practicable on the state of the art at that time; (4) measures of co-ordination wholly by separation should be considered with other measures of co-ordination where the former will not sacrifice economy and practicability and the convenience of rendering present and future service.

D. Neither party should assume to be the judge of the service requirements of the other system, or of what constitutes good practice in that system.

E. Existing cases to be cleared up in an orderly and systematic way as occasion requires in accordance with the above principles.

*II. Standards of Construction and Operation in Accord with the Foregoing Principles:*

A. Adoption of more detailed principles as soon as possible for temporary use.

B. Preparation by further co-operative work, based on the existing state of the art, of definite standards covering all classes of inductive exposures.

*III. Development Work:*

As soon as it can be done without interfering with the work recommended under II above, a co-operative study of the art shall be made in order to determine what practicable measures, if any, may be developed and adopted to lessen the contributing characteristics of both systems.

### CONCLUSIONS

Your sub-committee believes that great progress has been made toward the solution of the problems arising out of the proximity of supply and signal circuits and to further promote the satisfactory working out of these situations recommends as follows:

1. That the joint committee, if it approve, adopt the principles and standards herein set forth and recommend them for general use by the respective utilities.

2. That special emphasis be given to the importance of working out problems of interference before definite plans are made for construction, both with regard to immediate extensions and to general plans for future development.

3. That when differences do arise every effort be made to arrive at a settlement through negotiations rather than resorting to court or commission proceedings.

4. That arrangements be made for proceeding with further co-operative studies along the lines indicated herein.

## Lower Freight Rates on Coal Believed Certain

ADVICES from Washington state it to be a foregone conclusion that the Interstate Commerce Commission will order a reduction in coal freight rates. About 300 witnesses appeared during the general rate-reduction hearing. Every important industry was represented, as were the consumers and the public generally. One-sixth of those appearing expressed positive convictions that freight rates on coal should be reduced materially. Only one of the fifty asking for such a reduction represented coal producers. In view of a nation-wide unanimity of opinion that coal rates should come down, there is a general belief that the reduction will be a substantial one.

## Chicago Fire Wipes Out Stocks of Four Electrical Distributers

THE Chicago fire which destroyed the Austin, Atlantic and Burlington buildings on Wednesday morning completely consumed the stocks of the Electrical Supplies Company at 511 West Jackson Boulevard, the Co-operative Electrical Company at 314 South Canal Street, the James E. Gleason Electrical Company at 515 West Jackson Boulevard and the Consolidated Wire & Machinery Company at 527 West Van Buren Street. A. A. Togesen, manager of the Electrical Supplies Company, said to a representative of the ELECTRICAL WORLD that his firm was fully insured and that he would start anew immediately. The Co-operative and the Gleason companies also were insured.

Electric service in this section was not seriously interrupted. Only one feeder on the Commonwealth Edison distribution lines was affected. When this circuit became grounded in the burning building it was cut out and service for the district was obtained through another route.

## Urges Plant Rehabilitation Before Lowering Rates

REMOVAL of restrictions and insistence on plant rehabilitation, thereby insuring adequate and efficient service, was indicated by John W. Shartel, president of the Oklahoma Utilities Association, at its annual meeting this week in Oklahoma City, as the attitude that should be adopted by state regulatory bodies. Until this shall be done the question of lower rates should be kept in the background and utilities should be allowed to charge rates sufficient to insure such a result.

The indeterminate franchise was characterized by J. W. Dana of Kansas City as an unfortunate expedient. Mr. Dana contended it would be better if for the term "indeterminate franchise" were substituted the term "indefeasible street rights." This, he said, meant definitely giving to the utilities the same right to the use of the streets that is enjoyed by any other user of the public highways.

Elmer Schoggin of Little Rock, Ark., urged accident prevention as one method of increasing net revenue without encountering opposition from any one. The human element was viewed as the biggest cause of accidents, and newspaper advertising and educational work within the schools and among the company employees were suggested as the best means of preventing accidents. Discontented employees were declared to be a prolific source of accidents, and steps to correct the causes of discontent or as a last resort to get rid of such employees were recommended.

## Politicians Organize to Push California Water and Power Act

THE latest development in the fight in California over the proposed state water and power act is the formation of an active committee to lead the campaign for the passage of the measure. This committee is largely composed of city mayors, state senators and other politicians, with a sprinkling of small-town newspaper editors. Funds are being solicited.

Although it is too early to predict how the election will go, there are indications that the measure, even if defeated, will not be beaten by the overwhelming vote that the business and industrial interests of the state desire. A bare majority of the votes cast will suffice to carry the measure. There are indications at this early date that more than one-third of the total vote will show a desire for this form of state socialism. Many of the smaller newspapers, and even several of the more influential ones, are strongly in favor of the bill.

## Connecticut Commission to Approve Joint-Pole Use for Over 5,000 Volts

THE rules and specifications governing joint-pole construction which were submitted to the Connecticut Public Utilities Commission on Monday of this week by the utilities committee will, according to A. E. Knowlton, electrical engineer of the commission, probably, with slight modifications, be adopted shortly by the commission. These rules were prepared in co-operation with the commission's engineering staff.

These rules are considered quite a step forward in that they provide for joint use of poles of power and telephone circuits of over 5,000 volts as well as for pressures not exceeding 5,000 volts.

## Engineering Council Not Favorable to Muscle Shoals Investigation

AT THE Chicago meeting of the American Engineering Council's executive board on March 10 a proposal to take part in the governmental investigation of the Muscle Shoals development was laid on the table. Opposition to the proposal was based on the considerations that many investigations had already been made, that any inquiry to be adequate at this time would cost from $150,000 to $200,000, and that what was really needed was a consistent summing up of the engineering factors involved.

The Great Lakes-St. Lawrence waterway project, which had been discussed at two previous meetings, was laid on the table for somewhat similar reasons. It was emphasized in both cases that the public needed an *ex parte* statement representing the point of view of engineers as a whole with regard to the engineering factors and that the difficulty lay in finding, without a considerable appropriation, a group of men who could sift out from the mass of controversial material the

facts which would rightly represent the relation of the engineering factors to public policy.

Other matters coming before the meeting were an indorsement of the action of the National Board for Jurisdictional Awards in its controversy with the carpenters' union, congratulatory messages on the passage of the federal legislation to reform the United States Patent Office, discussion of the international organization of engineers, including the possible constitutional changes necessary to admit the Engineering Institute of Canada, and the indorsement of the Sterling reclassification bill.

Employment service, which the committee on that subject believed should be turned back to the jurisdiction of the constituent societies, was left unchanged, but a new committee was authorized to bring in a report. It was intimated that possibly some working arrangement might be made with the American Association of Engineers. The existing committee held that the fundamental object of the Federated American Engineering Societies is the rendering of service to the public where engineering problems are involved, while employment service is essentially personal, the direct personal contact of the engineer being with the constituent societies.

It was reported that the financial outlook of the federation for 1922 is much brighter than it appeared at the time of the meeting of council in January.

## Electrical Contractors' Association Changes Constitution

NUMEROUS changes were made in the constitution of the National Association of Electrical Contractors and Dealers at the meeting of the executive committee Monday and Tuesday this week at headquarters in New York, all tending to make it easier for the organization to function as a national body. The various committees reported and officers were elected. James R. Strong of New York was re-elected president. Changes in the constitution will have to be ratified at the annual convention in Cincinnati in October.

It was voted to change the name of the organization to the International Association of Electragists. A new form of geographical representation is recommended. Heretofore the executive committee has consisted of nineteen members. It is now proposed to increase the number of divisions from four to eight and let each division select one executive committee member, in addition to which there is to be one member at large and two from the new labor sections, making in all eleven members.

By the formation of the two labor sections it is proposed that the labor question shall no longer come up at the executive committee meetings or on the floor of the convention. A questionnaire disclosed that out of 12,761 men, employed by 1,100 electrical contractors, 6,489 were union men and 6,272 non-union. The new matter in the constitution forming the sections is as follows:

Sec. 1. Such members as so desire may form a section of this association for the purpose of making contracts or agreements or conferring with labor unions, but the business of such section shall be confined to labor matters. This shall be known as the Union Shop Section.

Sec. 2. Such members as so desire may form a section of this association to operate open or non-union shops. The business of such section shall be confined to labor matters. This shall be known as the Open Shop Section.

Sec. 3. Each section shall elect its own chairman, who shall automatically become a member of the International Association executive committee.

Sec. 4. In the conduct of labor matters the Open Shop and Union Shop Sections shall enjoy complete autonomy, except as hereinafter provided.

Sec. 5. Both the Open Shop and Union Shop Sections shall appoint from their membership three members, of whom the chairman of the section shall be one. These six will form the labor committee of this association. The creation of this committee will enable the Open Shop and Union Shop Sections to co-operate if they so desire in labor matters of mutual interest.

Sec. 6. Each of the sections shall have full control of its own funds and may levy upon its members such additional dues or assessments as it may deem necessary; but no International Association funds shall be used to promote the work of either section. Neither section shall make any rules or contracts in conflict with the International Association's constitution and by-laws or contrary to state or federal laws.

Sec. 7. Neither the Union Shop nor the Open Shop Section may admit to membership any person, firm or corporation not a member of the International Association.

Another important change in the constitution enables the members to come into direct contact with the national body rather than having to go through a state or regional body. It was felt that this would not only strengthen the national body but at the same time would encourage development of more local organizations.

The central-station committee indorsed the National Electric Light Association business development campaign and the national association pledged its fullest co-operation.

Within the next few months the cost data committee will, it reported, issue an estimating manual. It is proposed by the committee on the data and sales book to give it more of the character of a data book.

Considerable interest was taken in the report of the electrical code committee, which again went on record as advocating the use only of approved apparatus and material of both foreign and domestic manufacture. The committee reported that investigations were being made with respect to raising the 660-watt standard. If the results are favorable, the committee will recommend that a higher safe rating be given to outlets, always keeping in mind, however, that proper safeguards must be provided.

## City of Los Angeles Protests Against State Regulation

OPEN conflict with the California Railroad Commission over the control of the utilities within Los Angeles is expected as a result of the Board of Public Utilities of Los Angeles having notified the commission that the authority of the state body over these utilities is at an end. The notification declares that the so-called "gentlemen's agreement" under which the city surrendered many of its regulatory powers to the commission some years ago is to be canceled and that the board is willing to enter into a friendly suit with the commission to determine the jurisdiction of each. Whether or not this is a move of the city to forestall regulation by the commission of the Los Angeles Bureau of Power & Light, which operates the electric system of the city, in the event that the initiative measure to effect this is passed in the November election, will probably be made clear by court action. The city desires to regain complete regulating power over all its utilities.

## Water-Power Permit Asked

APPLICATION for a preliminary permit has been made to the Federal Power Commission by the Mokelumne River Power & Water Company, which has its headquarters at San Mateo, Cal. The project consists of the proposed diversion of the waters of the middle fork of the Mokelumne River to a reservoir at the headwaters of the north fork of the Calaveras River. Two dams and a canal 65 miles long are involved. The proposed use is for irrigation and power for public utility purposes.

## Kansas City Plant Being Increased 50 per Cent in Capacity

ADDITIONS to the Northeast plant of the Kansas City Power & Light Company are under way that will increase the capacity 50 per cent. At present there are three units, totaling 60,000 kva., in service in the plant. A 30,000-kva. unit is in process of installation, and with it are four 1,250-hp. boilers. Power service at 25 cycles has been given in the city heretofore from the plant, which was originally built for railway and power service and is owned by the street-railway system. This has been changed over so that now the entire light and power service in the city is at 60 cycles.

## Northern Ohio Traction & Light Issues $7,500,000 in 6 per Cents at 96

THE most interesting feature of the week's financing was the new issue of $7,500,000 of twenty-five-year general and refunding mortgage series A 6 per cent gold bonds of the Northern Ohio Traction & Light Company at 96, yielding slightly over 6.3 per cent. The proceeds will reimburse the company for construction expenditures during the past two years and for the retirement of $1,145,000 first-mortgage 5 per cent gold bonds of the Canton-Akron Railway Company which matured March 1, 1922, and, through redemption, the entire outstanding issue of $2,454,200 secured 7 per cent gold bonds.

## S. E. D. Establishes Clearing House for Association Meeting Dates

THE Society for Electrical Development has announced that it has established as a gratuitous service to the industry a clearing house for the scheduling of electrical meetings. This action has been taken in direct response to an editorial suggestion in a recent issue of the ELECTRICAL WORLD in which it was pointed out that the too frequent conflicts between meetings of different groups of electrical men interfere with the attendance of many.

The Electrical Supply Jobbers' Association has offered to co-operate by forwarding to the society tentative dates set for important meetings and receiving information as to what other meetings may have been set for the same date so that, if advisable, conflict can be avoided. It is believed that the other associations will take similar action in the same spirit of co-operation. It will not be possible, it was stated at the office of the society, to establish this service immediately on a basis that will embrace all meetings of all the associations within the industry without special provision in the society's budget for the work that would be entailed. The society expects, however, to be able to function at least so far as the principal gatherings of the more important electrical organizations are concerned.

## Great Western to Buy Out Spreckels Block Power Company

CONSOLIDATION of the Great Western Power Company of California and the Universal Electric & Gas Company of San Francisco is to be effected by purchase of the latter company by the Great Western Power Company for a price of approximately $2,500,000.

Final transfer of the properties and approval of the contract is subject to a hearing by the California Railroad Commission. The Universal Electric & Gas Company has a small steam generating station and serves approximately 4,250 consumers in the central portion of the city of San Francisco.

In the application to the commission the Universal company covenants not to engage in the electric or steam business in the city and county of San Francisco so long as the Great Western or its successors continue in business. This merger is expected to clarify materially the San Francisco electric light and power supply situation. R. J. Spreckels, who is vice-president of the Universal company, has been an advocate of the block system of electric service. While the Universal company has not a great number of customers, still its existence has frequently been of considerable annoyance to the local public utilities.

## Work Under Way on New Southern Power Hydro-Electric Plant

CONTRACT for the building of the 80,000-hp. hydro-electric plant of the Southern Power Company at Mountain Island has been awarded to the Rhinehart-Dennis Company of Charleston, W. Va., at a price to aggregate around $3,000,000, officials of the company announced last week. The construction work is already under way. Houses have been erected for officials of the contracting company and other preliminary steps have been taken. It is estimated that it will require two years for the construction of this development.

The plant will be the second largest development of the company, being exceeded by the Wateree (S. C.) station, which has a capacity of 85,000 hp. The dam at Mountain Island will be 80 ft. in height.

The company proposes also to begin at an early date the development of another plant at Great Falls, S. C., where an additional 60,000 hp. will be developed.

## Equipment Contracts for $3,500,000 Let by California Utility

CONTRACTS totaling approximately $3,500,000 have just been let by the Southern California Edison Company covering complete generating equipment and auxiliary apparatus for a 75,000-kw. hydro-electric station, an additional 16,000-kw. generator in an existing hydro-electric station, miscellaneous apparatus for several substations and the conversion of the present 150,000-volt Big Creek lines to 220,000-volt operation.

This apparatus is to be used in a new station, Big

Creek No. 3, in Big Creek No. 1, in stations on the Big Creek transmission lines and terminal substations. The first two units in Big Creek No. 3 and the additional unit in Big Creek No. 1 will be placed in operation in the spring of 1923, at which time it is planned to have the Big Creek transmission lines converted and reinsulated for operation at 220,000 volts. The third unit in Big Creek No. 3 will be placed in operation early in 1924 thereby bringing it to one-half its ultimate capacity.

The impulse wheel in Big Creek No. 1 will be supplied by the Allis-Chalmers Company, the reaction turbines in Big Creek No. 3 by the Wellman-Seaver-Morgan Company, the penstocks by the Kellogg company, the electrical equipment for Big Creek No. 3 by the Westinghouse Electric & Manufacturing Company, and the other equipment ordered will be supplied by the General Electric Company, excepting the switches which will be supplied by several manufacturers.

## Government and Industry Co-operate in Standardization

AT THE request of Secretary Hoover, the American Engineering Standards Committee has designated its retiring chairman, A. A. Stevenson, as a special representative to work with the Department of Commerce in co-operation with the department's division of simplified practice.

The division of simplified practice is a co-ordinating unit of the Department of Commerce assisting in those reductions of excessive variety and other simplifications which many industries are undertaking in order to decrease the cost of production and distribution of manufactured articles.

The American Engineering Standards Committee, which serves as a national clearing house for a broad field of engineering and industrial standardization, has offered Secretary Hoover the use of its machinery in carrying out the detailed work on technical projects initiated in the simplification program. The committee has been actively at work somewhat over two years, during which time it has brought about a large measure of industry-wide co-operation. In this work more than a hundred national organizations are participating through representatives officially designated by them.

## Electric Vehicle Show Next Month Attracts Many Exhibitors

MORE than thirty manufacturers have signified their intention of taking part in the electric vehicle show to be held from April 3 to April 15 in the showroom of the New York Edison Company at Irving Place and Fifteenth Street, New York City. During the first week street trucks ranging from 750 lb. capacity up to 5 tons will be shown. Passenger cars will also be displayed during this week. On April 9 the "big fellows" will give way to electric industrial trucks, and the second week will be devoted to the demonstration of methods of handling materials at freight stations and in industrial plants. Accessories will be exhibited both weeks.

A luncheon will be held at the Hotel Astor on Tuesday, April 4, and an electric vehicle conference will be held during the street-truck show, when problems concerning the operation of street trucks will be discussed. A second conference is to be held during the week given over to industrial trucks.

## To Give Short Meter Course at Yale

TO GIVE electric metermen a better understanding of the increasingly technical requirements of commercial measuring instruments and methods a course will be given on April 17 to 22 at the Dunham Laboratory of Electrical Engineering, Yale University, New Haven, Conn.

The Public Utilities Commission of Connecticut maintains its standardizing laboratory at the school, and the commission's electrical engineer, Prof. A. E. Knowlton, will have charge of the course. Meter manufacturers will supply literature, sample instruments, and in some cases a representative. The course will be conducted as far as possible in accordance with the recommendations of the meter committee of the National Electric Light Association. A supplementary program includes addresses by M. H. Aylesworth, executive manager N. E. L. A.; B. W. St. Clair, General Electric Company, West Lynn, Mass., and A. J. Campbell, Samuel Ferguson and G. B. Leland of the Waterbury, Hartford and Stamford central-station companies. Radio telephony and radio-frequency metering will also be demonstrated.

## To Celebrate Forty Years of Electric Service in New York

ARRANGEMENTS are being made to celebrate this fall, probably on Sept. 4, the fortieth anniversary of the beginning of New York central station service.

On Sept. 4, 1882, New York's first central station and underground system of distribution were completed and placed in operation according to plans conceived and executed by Thomas A. Edison. The original generating station occupied a reconstructed brick warehouse at 255 and 257 Pearl Street and supplied a distribution system serving only a square mile of territory. There were fewer than sixty customers when service began. Energy was used only for lighting, and there were only 1,200 lamps in all in the customers' premises. Today the Edison system in New York supplies 296,560 customers and is used for lighting approximately 9,000,000 lamps, for operating 688,000 hp. in motors and for heating purposes to the extent of 12,800 kw.

On the occasion of the thirty-fifth anniversary of the beginning of service the American Scenic and Historic Preservation Society and the New York Edison Company caused to be placed on the site of the original station a bronze tablet setting forth the facts connected with this important event in electrical history.

## Electric Signs Barred from Fifth Avenue, New York City

A DECISION handed down last week in the Supreme Court of New York State has sustained an ordinance of the city of New York barring electric signs on the fronts of buildings in Fifth Avenue from Washington Square to One Hundred and Tenth Street, in Madison Avenue from Thirty-fourth to Seventy-second Street, and in Thirty-fourth and Fifty-seventh Streets for several blocks in the neighborhood of these avenues.

Judge Vernon M. Davis, who gave the decision, held that the law was not discriminatory and was in the "interest and convenience of the public." The finding opens the way to other municipal legislation restricting electric signs.

# Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

**Electric Safety Lamps in British Mines.**—Electric lamps to the number of 245,900 were used in British mines in 1920, as compared with 197,722 in 1919. There was a drop in the flame safety lamps from 636,158 to 635,127, but lighting by electricity was used for 422,167 of these as against 418,344 in the previous year.

**Tampa Replaces Gas with Electricity.**—The City Commissioners of Tampa, Fla., have ordered the substitution of electric lighting for gas lighting in nine out of thirty-six sections into which the city has been divided and the Tampa Electric Company will complete the new installation, with the exception of the Bayshore Drive, in 120 days.

**All Sweden Linked Up Electrically.**—Sweden now has an interconnected electric power system extending from Norrland, in the extreme north, to Skane, in the south. Advices to the Department of Commerce tell of the completion of the last link in the system, which covers the 196 miles between Trollhättan and Vesterås. The line is intended to carry 220,000 volts.

**Facilitating Reference to Bureau of Standards Papers.**—A new grouping of the technologic papers of the Bureau of Standards into consecutively paged volumes has been adopted by the bureau in order to make reference and citation simple. A leaflet explaining the method and giving the terms of subscription has been issued by the bureau, which may be addressed at Washington, D. C.

**University of Arkansas Offers Metermen's Course.**—The College of Engineering of the University of Arkansas, in co-operation with the Arkansas Utilities Association, will conduct a metermen's course from April 14 to April 19. This course will consist of a study of the fundamentals of polyphase alternating-current watt-hour meters, instrument transformers and demand meters.

**Pennsylvania Police Adopt Wireless Reports.**—A system of sending crime reports by wireless will soon be placed in operation throughout the state by the Pennsylvania State Police and promises to be of great use as a check on criminals. The mast for the broadcast station has been erected at the State Arsenal in Harrisburg, and receiving stations are being fitted up in Butler, Greensburg, Pottsville, Wyoming and Lancaster. The municipal police chiefs of nearly all the large cities up the state have volunteered to build stations and co-operate.

**New York Electrical Show to Go Back to Grand Central Palace.**—The 1922 New York Electrical Show is to be held from Oct. 7 to Oct. 14 at the Grand Central Palace. Last year's show was held elsewhere, and owing to the limited space the number of exhibits had to be greatly curtailed. This year an exhibition on the scale of other years will be held in the quarters used prior to 1921.

**British Institution Celebrates Jubilee.**—In commemoration of the first meeting of the Society of Telegraph Engineers, which took place on Feb. 28, 1872, the Institution of Electrical Engineers held a semi-centennial "jubilee" comprising a series of special meetings at its London headquarters. One of the features of this celebration was an experimental lecture by Dr. J. A. Fleming upon "Michael Faraday and the Foundation of Electrical Engineering." Early history and reminiscence were the basis for most of the papers and proceedings.

**Electric Expansion at Cape Town.**—Growing demand for electric heaters and appliances for domestic use at Cape Town, South Africa, has necessitated an expansion of the municipal electric light and power plant. The department of electricity is gradually substituting three-phase alternating current for direct current. The Cape Province Council recently enacted an ordinance empowering municipalities to insist on registration of electrical contractors and licensing of electric wire men in the interest of better electric connections and lighting and power service.

**Accomplishments of Missouri Committee on Public Utility Information.**—This committee, in active operation since Oct. 1, 1921, had up to Jan. 31 of this year established favorable contacts with 600 newspapers in the state, issued 15,000 copies of a new bulletin (which has now been made a monthly with a circulation of 7,200), kept a complete record of taxation upon utilities, maintained a speakers' bureau, interested the universities of the state in its work, got into close touch with forty-six operating utilities, held regional meetings of operators, and formulated a plan by which the salesmen of manufacturers and jobbers will further its work.

**Automatic Telephone Proposed for France.**—Complete financial and technical reorganization of the French telegraph, telephone and postal service is provided for in two bills which have been submitted to the Council of Ministers. According to advices received by the Bankers' Trust Company of New York, the new bills provide for the creation of an entirely separate budget for each of these three services, which were formerly provided for jointly. Improvement and extension of the telephone lines is contemplated at an estimated cost of at 1,675,000 francs. One feature of the proposed changes is the installation of automatic telephones both in ordinary city exchanges and in rural districts.

# Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

**Rochester Engineering Society.**—The quarter centennial of this society is to be celebrated tonight (March 18) at the Powers Hotel, when the members of all the local engineering bodies will join in a dinner.

**New York Electrical League.**—Frank W. Smith, vice-president of the United Electric Light & Power Company, will talk on the development of the alternating-current system in New York City at a luncheon of the New York Electrical League on next Wednesday, March 22, at 12:30 o'clock, at the Hotel Astor, after which those present will be invited to visit the company's new Hell Gate station.

**Early Meetings of A. I. E. E. Sections.**—Programs of section meetings scheduled for early dates are: Cleveland, March 21, "Power-Plant Economics, with Special Reference to the Steam Turbine," by T. E. Keating of the Westinghouse Electric & Manufacturing Company; Erie, Pa., March 21, "Electrochemistry," by Mr. Swartz; Philadelphia, March 21, hydro-electric symposium; Akron, March 22, "Illumination," by A. R. Holden; Toronto, March 24, joint meeting at Hamilton, and April 7, "Explanations and Demonstrations of Power Factor," by Prof. H. W. Price; Atlanta, March 30, "Steam Turbines," by E. F. McLaughlin of the General Electric Company; Utah, March 31, "Illumination and Eye Strain," by H. T. Plumb; Vancouver, B. C., April 7, "Safety Card in City and Suburban Service," by H. M. Lloyd.

### Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Pittsburgh, March 18; Youngstown, March 25; Birmingham, March 25; Cleveland, April 10; Philadelphia, April 18.

A. I. E. E. Section Meetings.—Cleveland, March 21; Erie, March 21; Philadelphia, March 21; Akron, March 22; Toronto, March 24 and April 7; Atlanta, March 30; Utah, March 31; Vancouver, April 7.

Wisconsin Electrical Association—Milwaukee, March 22-24. (For program see issue of March 11, page 496.)

A. S. M. E. Spring Meeting—Atlanta, April 8-11.

A. I. E. E. Spring Convention—Chicago, April 19-21.

Tri-State Water and Light Association—Spartanburg, S. C., April 19-21.

American Physical Society—Washington, April 22.

American Electrochemical Society—Baltimore, April 27-29.

N. E. L. A. Annual Convention—Atlantic City, May 15-19.

N. E. L. A. Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.

# Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

**United States Supreme Court Declares New York Gas Laws Confiscatory.**—The eighty-cent and dollar gas laws of New York State, which have been fought persistently by the gas companies of Greater New York and which the city authorities have tried to enforce, have been finally declared confiscatory by the United States Supreme Court in a unanimous decision, and as a result about $20,000,000 of funds impounded by the state courts to reimburse customers should the decision go against the companies has been released to the utilities. This sum was accumulated under the operation of a rate of $1.20 per 1,000 cu.ft. The decision puts the making of a new rate squarely up to the Public Service Commission, the Supreme Court saying: "Rate making is no function of the courts and should not be attempted either directly or indirectly. We do not intend by anything said herein to intimate what would have been a reasonable rate for the sale of gas under the circumstances disclosed. The eighty-cent rate was confiscatory; the one-dollar-and-twenty-cent maximum imposed by the court during a specified period as a condition to the injunction was a limitation in favor of the consumers." Regarding the suggestion that the loss of income during the war period should be made up out of prior earnings, the court said that "mere past success could not support a demand that the company continue to operate indefinitely at a loss."

**The Theory of a Service Charge.**—In declaring the imposition of a service charge to be legal, in the suit of the People vs. Rochester Gas & Electric Corporation (see issue of March 11, page 500), the New York Court of Appeals made this defense of the practice: "The expenses of a gas company are incurred partly in manufacture and partly in distribution. Its income must be adequate to reimburse it for the one outlay as for the other. Expenses of manufacture may be apportioned among consumers in proportion to the quantity of gas consumed. Expenses of distribution in their division may follow other lines. Some remain constant whether consumers are few or many. Others increase or diminish at a uniform rate with the number of the patrons. A service charge is an attempt to make the incidence of the burden as wide as the incidence of the benefit. From all the items included in the cost of distribution it segregates and divides per capita those dependent upon numbers. Such items there always are. . . . The law imposes the duty to establish connections for the householder who demands them, but it does not impose the duty either to install or to maintain them gratuitously. If he demands the facilities with the added expense that follows, he thereby invites a service and must be numbered among those for whom service is maintained. A service charge is not something in addition to the price that would otherwise be fair and reasonable. It enters into the price of the commodity not as an element of addition but as an item of deduction. In the case at hand the finding is that if the service charge were dropped the price of gas, now $1.30, would become $1.45. The revenues of the company are the same whether rates are computed on the one basis or the other. The variance is solely in the distribution of the burden."

**Commission's Course Found to Constitute a Denial of Due Process of Law.**—Remanding for further proceedings, an action brought by the Appalachian Power Company against Commonwealth ex rel. National Carbide Corporation, the Supreme Court of Appeals of Virginia declared the action of the commission in adopting a rate for electric power recommended by its engineer without giving the power company the opportunity to be heard was a denial of a hearing and of due process of law. The court also insisted that on an appeal from an order fixing rates the commission must certify the facts found and not merely the evidence upon which its order was based, as otherwise it is impossible for the appellate court to know to what facts or conclusions it should give the prima facie presumption of correctness. (110 S. E., 360.)*

**Company's Responsibility for Accident Which Was Due to Proximity of Decayed Tree to Transmission Line.**—A transmission line of the Hagerstown & Frederick Railway Company was broken by the impact of a large limb falling from a decayed tree, and the broken wire came in contact with a wire fence, thus bringing about the death of a child who touched the fence while running to the scene of the accident. The trial court admitted evidence to show that limbs had previously fallen from the same tree and that the company was chargeable with knowledge of the danger from the tree's condition. The Court of Appeals of Maryland, in an appeal brought by the company against the state (for use of Weaver), has found that this evidence was properly admitted, that the company was required to protect persons using the public highways against danger from its transmission wires, and that the company should have had the tree limb removed or have taken other precautions against accident, even though the tree was not on its right-of-way. (115 At. 783.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

**Powers of Nebraska Commission.**—On application of the Brittan Electric Light & Power Company for authority to issue and sell bonds, the Nebraska State Railway Commission declared that it had no jurisdiction as to security issues over a company organized under the common law as a "declaration of trust" company.

**Reducing Rates Because of Inadequate Service.**—In reducing the rates of a gas company, the Indiana Public Service Commission said: "A public utility is entitled to earn its proper operating expenses, including taxes and depreciation and a reasonable return on the fair value of its property, if it furnishes reasonable service. The evidence in this case shows, and at the hearing respondents admitted, that the gas service in New Albany is not adequate."

**Rate Base in Depopulated Community.**—Holding that the usual formulas of reproduction value or of historical cost could not be used to establish the rate base of a water utility which, on account of large decrease in population, was serving only a fraction of the number of consumers for which the plant was originally constructed, the Arizona Corporation Commission established a rate base after consideration of the cost of the property to the present owners, who had purchased at a time when there were no net earnings. Allowance for depreciation was reduced.

**Separate Schedules for Rural Localities Condemned.**—In adjusting rates for the Badger Electric Service Company the Wisconsin Railroad Commission remarked in explanation of why it treated as a unit the six communities affected: "In considering the suggestion that a separate schedule be established for each locality served by the applicant, we desire to point out that to fix a separate schedule for each community and for each farm line would necessitate the apportionment of the property as well as a very detailed apportionment of the joint operating expenses. In fact, to allocate all possible expenses direct to a particular locality would necessitate a much more elaborate accounting system, which would mean considerable additional labor expense. This extra expense would have to be apportioned among the communities served. . . . In fact, it is only by combining a number of localities similar to those supplied in this case that a reasonable schedule of rates can be obtained for each."

# Men of the Industry

**Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry**

**V. L. Board**, for twelve years a member of the Doherty engineering staff, has been appointed to the newly created position of assistant general manager of the Denver Gas & Electric Light Company. Mr. Board not only succeeds to the responsibilities of the operating

V. L. BOARD

department formerly discharged by Superintendent T. O. Kennedy, but he will also exercise executive supervision over all branches of the company's activities. He was graduated from the University of Missouri in 1910 and became identified with the Denver Gas & Electric Light Company the same year in the capacity of junior engineer. At the end of two years he was transferred to the New York offices of the Doherty interests, where he was engaged in engineering and rate work. In 1917 he was assigned to special work with the Denver Gas & Electric Light Company. Mr. Board is secretary-treasurer of the Rocky Mountain Committee on Public Utility Information, in the organization of which he was instrumental.

**John W. Lieb**, vice-president of the New York Edison Company, accompanied by Mrs. Lieb, is leaving for a three months' trip to Europe on March 8 on the steamship Arabic of the White Star Line, bound for Naples via the Mediterranean route. Mr. Lieb expects to visit Italy, Switzerland, France, Germany, Holland and England, but will spend most of his time in Italy visiting his old friends and business associates. He was chief engineer and technical director of the Italian Edison Company from 1882 to 1894, and many engineers who were on his staff at the time are now occupying prominent positions as executives or managers of electric light and power companies in different parts of Italy. While in Europe he will be interested in the latest engineering developments, particularly in connection with the construction and operation of power plants and transmission systems. He will also endeavor to strengthen the international relations between the principal engineering societies in the United States and the national engineering societies in Italy. While in Rome Mr. Lieb will present the certificate of honorary membership in the American Society of Mechanical Engineers which was recently conferred on Gr. Uff. Pio Perrone. Mr. Lieb will also convey the felicitations of the American Institute of Electrical Engineers to its sister society, the Associazione Elettrotecnica Italiana, on the twenty-fifth anniversary of its organization, which it celebrates this year. Mr. Lieb is a past-president of the Association of Edison Illuminating Companies, the National Electric Light Association, the American Institute of Electrical Engineers, the New York Electrical Society and the Edison Pioneers.

**Charles A. Culver**, recently elected president of the Radio Research Club of Canada, is chief high-frequency engineer of the Canadian Radio Corporation, Ltd. Mr. Culver was graduated from Carleton College, Northfield, Minn., in 1902, and received the degree of doctor of philosophy from the University of Pennsylvania in 1907. Immediately after graduation he took charge of the department of physics in Beloit College, Beloit, Wis., remaining as head of that department until, in July, 1920, he resigned to take charge of high-frequency engineering work in connection with the development of guided-wave telegraphy and telephony in Canada. When the United States entered the war Mr. Culver obtained leave of absence from Beloit College and served in the United States Army on the staff of the Chief Signal Officer, holding the rank of major when discharged. During the greater part of his military service he had charge for the Signal Corps of an investigation into trans-atlantic radio communication which was perhaps the most comprehensive piece of research work into trans-oceanic communication ever carried out.

C. A. CULVER

**B. F. Sunny**, president of the Illinois Bell Telephone Company and formerly

B. F. SUNNY

for nearly fourteen years president of the Chicago Telephone Company, has retired to become chairman of the board of directors of the Illinois company. Mr. Sunny resigned as vice-president and Western manager for the General Electric Company in May, 1908, to become head of the Chicago Telephone Company. His retirement from the active management of the telephone company removes one of the outstanding executives in the utility field. He came into the electrical industry as a messenger for the Atlantic & Pacific Telegraph Company, going to Chicago for that company in 1875. He joined the Bell Telephone Company in 1879 as superintendent in Chicago. In 1888 he became president of the Chicago Arc Light & Power Company, and later he was general manager of the Thomson-Houston Electric Company and Western manager of the General Electric Company. From 1911 to 1920 he was president of the central group of Bell companies operating in Illinois, Wisconsin, Michigan, Indiana and Ohio. These are now operated as separate organizations.

**Rumsey W. Scott** was elected a vice-president of the Chemical National Bank of New York at the annual election of officers. Through a mistake it was announced in the ELECTRICAL WORLD of Feb. 25 that Mr. Scott had been elected president of this bank.

**H. D. James**, manager of the control engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been re-elected president of the Engineers' Society of Western Pennsylvania. Mr. James has served as director of the society for three years and has been president for the last two years. He was graduated from the University of Pennsylvania in 1906, and after spending five years with the Westinghouse Electric & Manufacturing Company he became connected with the Union Gas

H. D. JAMES

& Electric Company of Cincinnati as power engineer. Mr. James served in the war and at the time of his re-entering the employ of the Westinghouse company was with the Chase Engineering Company of Cincinnati.

**I. R. Reddinger**, president of the Reddinger-Ball-Morris Electric Appliance Manufacturing Company, Logansport, Ind., has disposed of his interests to M. W. Morris, vice-president of the company.

**Henry Harnischfeger**, president of the Pawling & Harnischfeger Company, electric crane manufacturer, Milwaukee, left on Jan. 28 on a combined business and pleasure trip around the world, accompanied by his wife. The trip will extend to Japan, the Philippines, China, Burma, Ceylon, India and Europe, and Mr. Harnischfeger will investigate general business conditions and possibilities in the Far East.

**Horace B. Smith** has been appointed manager of the domestic service section of the industrial department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Mr. Smith was born at Martinsburg, Pa., and spent his early life in Altoona, Pa., where he was educated. He attended Yale University, where he was graduated in electrical engineering in 1906. From 1906 to 1908 he was engaged as an engineering apprentice with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, and in 1908 he traveled abroad. From 1909 to 1911 he was engaged as assistant chief electrician of the Allegheny Steel Company, Pittsburgh, Pa., and in 1911 entered the employ of the industrial sales department of the Westinghouse company, where he has been continuously since that time. As manager of the domestic service section, Mr. Smith will have charge of the Westinghouse company's dealings with the baking, confectionery, canning, preserving and other industries.

**E. C. Headrick**, vice-chairman of the Denver Electrical Co-operative League since its inception last year, has been appointed chairman to succeed T. O. Kennedy, who left that post recently to assume management of the Ohio Public Service Company. Mr. Headrick has been one of the prime factors in developing the co-operative effort in Denver. He has just completed a term as president of the Electrical Contractors and Dealers' Association of Denver. He is also chairman of the building committee of the co-operative league and will have charge of the building of Denver's first electrical home.

**W. O. Renkin**, formerly chief engineer for the A. M. Byers Company, Pittsburgh, has been appointed engineer in charge of the Quigley pulverized-fuel department of the Hardinge company, New York. Mr. Renkin obtained his enginering education through a special course conducted by Prof. R. H. Thurston of Cornell University in 1894 and 1895 and upon completion of this course went into the Renkin shops at Pittsburgh, where he specialized on the problems attendant on the manufacture of steam-power apparatus. He then was placed in charge of construction in several plants, including work in Toulon, France. Four years were spent in Jamshadpore, Bengal, British India, as resident engineer in charge of pioneer construction for the Tata Iron & Steel

W. O. RENKIN

Company, a modern steel plant and a community settlement for the workingmen being built. Returning from India, he became connected with the Byers company and there studied pulverized-fuel problems.

# Obituary

**George F. Parker**, vice-president and general manager of the New York Electrical Show Company and president of the Fox Electrical Corporation, died on Tuesday, March 7, at his home at Hasbrouck Heights, N. J., at the age of fifty-two. His death was due to heart trouble, from which he had been suffer-

G. F. PARKER

ing for almost a year. To Mr. Parker is due most of the credit for the success of the electrical shows in New York, which have been held since he opened the first show in Madison Square Garden in 1907. From but a few exhibitors he saw the shows grow to several hundred, including manufacturers of virtually every kind of electrical apparatus and appliance for home or industrial use. Mr. Parker acquired his experience in managing large exhibitions while employed by several well-known circus companies.

**James W. Gore**, manager of the North Virginia Power Company, died on Feb. 1 in Millville, W. Va., at the age of fifty-four years.

**Colonel John Lambert**, first president of the American Steel & Wire Company and an associate of John W. Gates and E. H. Gary in the formation of the United States Steel Corporation, died at his winter home in Pasadena, Cal., on March 7.

**Dr. Charles W. Waidner**, chief physicist of the Bureau of Standards and widely known for his scientific studies of temperatures and heat measurements and applications, died at his home in Washington on March 11. Dr. Waidner was a native of Baltimore and a graduate of the Johns Hopkins University. Before joining the Bureau of Standards, soon after its establishment in 1901, he was an instructor in physics at Johns Hopkins and later at Williams College. He was a member of many scientific organizations and had written numerous scientific papers.

# Trade and Market Conditions

**Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies**

## Electrical Exports Continue to Drop in Value

JANUARY, 1922, signalized in the export world by the putting into effect of the new export classification of the Department of Commerce, proved a slow month for exports otherwise. The total value of electrical machinery shipped during the month to foreign buyers was $4,273,248, almost 75 per cent below exports for the same month last year. This mark is slightly under November, 1921, the lowest month in 1921, and $904,311 under December, 1921.

On the surface these returns are rather discouraging, but there are several factors which render the figures less depressing. One is the fact that normal seasonal influences tend to reduce January exports, and some at least of the decline from December can be accounted for in that way. However, when all is said, the fact remains that the export situation is quieter than at any time since 1915.

Comparison of subdivision totals with previous months is practically impossible owing to the lack of detailed information on those months. Only a few items in the new list stand out with more than ordinary totals. They are: 493,134 lb. of electrical porcelain, valued at $103,923; 628 generators, 500 kw. and over, valued at $185,073; 1,115,074 lb. of insulated wire and cable, valued at $234,537; accessories and parts for generators, valued at $250,605, and 122,529 switches, valued at $175,382.

## Price Drop Anticipates Spring Demand for Armored Conductor

MANUFACTURERS' quotations on flexible armored conductor have been dropped by several producers in the last two weeks, the reduction amounting to about 5 per cent. The new prices represent approximately the lowest levels reached since the early years of the war and should prove of considerable saving in the house-building campaign which is expected to develop this spring.

Some producers feel, however, that the change was untimely viewed from the angle of the manufacturer. They assert that the quotations just put into effect merely about cover the factory cost of armored conductor and that the commercial costs, such as freight charges and sales expenses, are left out of consideration. At least one manufacturer states that every foot of armored conductor sold at the new price will mean a loss to him. With the spring

ELECTRICAL EXPORTS FOR JANUARY, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

| | January, 1921 | | January, 1922 | |
|---|---|---|---|---|
| | Volume | Value | Volume | Value |
| Electrical glassware, except for lighting, lb. | ..... | ..... | 81,627 | $13,074 |
| Electrical porcelain, lb. | ..... | ..... | 493,134 | 103,923 |
| Carbons for electric lighting, electrodes and batteries, lb. | ..... | $70,823 | 203,082 | 19,312 |
| Insulated wire and cable (iron and steel), lb. | ..... | ..... | 513,483 | 80,618 |
| Other manufactures of aluminum, lb. | ..... | 521,965 | 88,502 | 40,602 |
| Copper wire (bare), lb. | 1,922,887 | 455,705 | 360,935 | 56,459 |
| Insulated copper wire and cable, lb. | ..... | 2,447,654 | 1,115,074 | 234,537 |
| Generators: | ..... | 629,461 | ..... | ..... |
| Direct current— | | | | |
| Under 500 kw., number | ..... | ..... | 628 | 28,621 |
| 500 kw. and over, number | ..... | ..... | 628 | 185,073 |
| Alternating-current— | | | | |
| Under 2,000 kw., number | ..... | ..... | 18 | 6,202 |
| 2,000 kw. and over, number | ..... | ..... | 77 | 80,022 |
| Accessories and parts for generators | ..... | ..... | 754,917 | 250,605 |
| Self-contained lighting outfits, number | ..... | ..... | 125 | 39,776 |
| Batteries: | ..... | 655,712 | ..... | ..... |
| Primary, dry, number | ..... | ..... | 257,480 | 71,306 |
| Primary, wet, number | ..... | ..... | 987 | 2,905 |
| Storage, wet, number | ..... | ..... | 6,361 | 51,216 |
| Transforming or converting apparatus: | | | | |
| Power transformers, number | ..... | ..... | 912 | 84,379 |
| Other transformers, number | ..... | ..... | 1,602 | 106,207 |
| Rectifiers, number | ..... | ..... | 28 | 4,987 |
| Condensers, double-current and motor-generators, dynamotors, synchronous and other converters, number | ..... | ..... | 258 | 62,885 |
| Transmission and distribution apparatus: | | | | |
| Switchboard and panelboards, except telephones, number | ..... | ..... | 284 | 45,066 |
| Switches and circuit breakers, number | ..... | ..... | 122,599 | 175,382 |
| Fuses and fuse plugs, number | ..... | ..... | 106,851 | 13,259 |
| Watt-hours and other measuring meters, number | ..... | ..... | 10,925 | 66,116 |
| Volt, watt and ampere meters and other recording indicating and testing apparatus, number | ..... | ..... | 3,942 | 68,006 |
| Lightning arresters, choke coils, reactors and other protective devices, number | ..... | ..... | 3,565 | 14,230 |
| Motors, starters and controllers: | | | | |
| Motors under 1 hp., number | ..... | ..... | 1,937 | 36,040 |
| Stationary motors— | | | | |
| 1 hp. to 200 hp., number | ..... | ..... | 1,283 | 145,883 |
| Over 200 hp., number | ..... | ..... | 13 | 4,427 |
| Railway motors, number | ..... | ..... | 1 | 390 |
| Electric locomotives, number | 9 | 95,016 | ..... | ..... |
| Railway, number | ..... | ..... | 1 | 17,505 |
| Mining and industrial, number | ..... | ..... | 3 | 8,926 |
| Other motors, number | ..... | 2,064,424 | 2,554 | 65,563 |
| Rheostats, controllers and other starting and controlling equipment, lb. | ..... | 161,253 | 182,652 | 73,535 |
| Accessories and parts for motors, lb. | ..... | ..... | 290,704 | 146,521 |
| Electric appliances: | | | | |
| Electric fans, number | 20,047 | 358,444 | 2,144 | 47,061 |
| Electric lamps— | | | | |
| Arc, number | 61 | 1,430 | 103 | 1,344 |
| Incandescent— | | | | |
| Carbon filament, number | 43,228 | 9,075 | 11,963 | 3,050 |
| Metal filament, number | 2,314,676 | 620,434 | 360,049 | 95,057 |
| Other electric lamps, number | ..... | ..... | 12,153 | 18,486 |
| Flashlights, number | ..... | ..... | 26,297 | 14,855 |
| Searchlights and projectors, number | ..... | ..... | 379 | 12,130 |
| Motor-driven household devices, number | ..... | ..... | 699 | 22,704 |
| Industrial electric furnaces and ovens, number | ..... | ..... | 31 | 22,951 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc., number | ..... | ..... | 443 | 41,703 |
| Signals and communication devices: | | | | |
| Radio and wireless apparatus, lb. | ..... | ..... | 7,215 | 9,274 |
| Telegraph apparatus, lb. | ..... | ..... | 9,333 | 25,380 |
| Telephone apparatus, including telephone switchboards, lb. | ..... | ..... | 289,476 | 370,055 |
| Police, fire and burglar alarm apparatus, lb | ..... | ..... | 3,026 | 3,856 |
| Railway signals, switches and attachments, lb. | ..... | ..... | 109,059 | 46,156 |
| Bells, buzzers and annunciators, number | ..... | ..... | 3,321 | 4,148 |
| Other electric apparatus: | | | | |
| Spark plugs, magnetos and other ignition apparatus, lb. | ..... | 303,900 | 112,776 | 104,311 |
| Insulating material, lb. | ..... | ..... | 254,396 | 56,498 |
| Metal conduit, outlets and switch boxes, lb. | ..... | ..... | 236,839 | 53,655 |
| Sockets, outlets and receptacles, number | ..... | ..... | 100,354 | 10,738 |
| Other wiring supplies and fixtures, lb. | ..... | 422,015 | 136,336 | 79,375 |
| Other electrical apparatus not elsewhere specified, lb. | ..... | ..... | 1,689,718 | 833,203 |
| Total Electrical Machinery | | | | $4,273,248 |

only a few weeks off, he expressed his belief that the makers of armored conductor should have waited to see whether there would not be sufficient demand to move stocks at the old price. If it had developed then that there would be no buying at the old price, he said, the cut could have been made and few sales would have been lost in the intervening time. So far the reduction has had little effect on sales.

The call for conductor during the past two months has been fairly steady, though not of large volume. Competition has been keen owing to good stocks. In the metropolitan district jobbers' quotations have been ranging from $43 to $44 per 1,000 ft. for the No. 14, two-wire single-strip, with the double-strip two dollars higher. Approximately the same conditions prevail in the Middle West. There are few sales of armored conductor on the Pacific Coast, because of the preference there for rigid conduit.

## Stoker Market Shows Improvement

SINCE 1922 began a better tone has been apparent in the market for mechanical stokers, and at present manufacturers are operating generally on a five-day week basis. The demand has not increased rapidly, but central-station companies in the Middle West have placed a number of orders for equipments of the latest types, and some important proposition work is pending. The Boston Elevated Railway, the United Electric Railways of Providence, R. I., the Public Service Electric Company (Essex station) and others are considering bids for new equipment, and important engineering developments are being tried out in connection with stoker application to very large boilers in the direction of improved coal-handling apparatus. Manufacturers are having no difficulty in procuring either material or labor of the best class, and deliveries of standard parts are being made easily from stock. In this field there is always more or less production of parts for factory stocks, and purchasers seldom have to wait for shipments beyond the transit time required. It is the opinion in manufacturing circles that business is likely to improve, although nothing spectacular is anticipated at present.

## February Construction Exceeds That of Year Ago by 73 per Cent

FEBRUARY construction activity was 73 per cent greater in volume than it was in the same month of last year, according to figures compiled by the F. W. Dodge Company. The total amount of contracts awarded last month in the twenty-seven Northeastern States of the country amounted to $177,365,000, an increase of 7 per cent over January and the second largest February total since the company began to collect statistics on the industry.

A significant feature of the February construction record lies in the increase in business buildings over January. The increase in square feet of space contracted for amounted to 30 per cent, and the increase in total cost was 65 per cent. February business buildings amounted to $39,180,000, or 22 per cent of the month's total, an unusually high percentage for this class, which was exceeded only by residential buildings, amounting to $75,703,000, or 43 per cent of the total. Public works and utilities took third place, amounting to $21,193,000, or 12 per cent of the total.

The accumulated volume of construction since the first of the year has been 60 per cent greater than in the first two months of last year. Contemplated new work reported in the first two months has amounted to more than $800,000,000, over twice the amount of work actually contracted for in the same period.

Contracts awarded in the New England States during February amounted to $15,623,000, more than double the amount for February of last year and the second largest February total on record for that section of the country. The month's building contracts in New York State and northern New Jersey amounted to $59,328,000, the largest recorded February total for that district. It was 250 per cent ahead of February last year. Work contracted for showed an increase over February of last year of 67 per cent in the Middle Atlantic States, 28 per cent in the Pittsburgh district, 39 per cent in the Middle West and 62 per cent in the Northwest.

## Clotheswashers Not Yet Popular in England

CLOTHES-WASHING machines have not been popular in the south of England, according to a report to the Department of Commerce by Consul Coulter at London, partly because servants object to having the laundry done at home. In the north country and in the industrial centers hand washing machines have found a good market. Cost militates against the American as well as the British and Canadian-made electrically driven machines. They retail for about £40 ($160) as against £7 to £8 ($28 to $32) for the hand-driven machines.

## Metal Market Situation

DEVELOPMENTS in the last two weeks indicate that the flurry of buying at the beginning of that period has changed into a healthy buying movement. At the end of last week producers and large selling agencies advanced the price of electrolytic to 13⅛ cents for May delivery and held March and April deliveries at 13 cents. Sales have been numerous, though rather light individually. Export demand is as good as, if not better than, domestic, and a rumor was current last week that one foreign order for 3,500,000 lb. had been booked. The Copper Export Association at the present time has no definite price, but outside interests are reported to have effected sales at 13¼ cents, c.i.f. European ports. In the domestic market, as has been the case for some time, wire drawers are the most active buyers.

There is reason to expect marked improvement in the statistical position of copper by the end of June. Assuming that domestic consumption and exports are likely to absorb 750,000,000 lb. of new refined copper during the first half of 1922 and that refinery output will not exceed 600,000,000 lb., a decided reduction will have been accomplished in the heavy surplus stocks carried over from last year. However, in addition to the output of refined copper there are large quantities of secondary copper recovered in this country. Reliable figures on the production of copper from secondary sources in 1921 are lacking, but during the year 1920 the total quantity of secondary copper recovered in this country at plants treating this sort of material amounted to 624,920,000 lb. and that in 1919 was 574,380,000 lb. Present government holdings of brass and copper scrap are unknown. Large quantities have been disposed of from time to time, and it is probable that further quantities will be offered for sale. The copper market cannot afford to ignore the fact that these secondary products play a big part in the copper situation on account of the margin in price between remelted and virgin metal.

### NEW YORK METAL MARKET PRICES

| | March 7, 1922 | March 14, 1922 |
|---|---|---|
| Copper: | £ s. d. | £ s. d. |
| London, standard spot | 60 2 6 | 60 12 6 |
| | Cents per Pound | Cents per Pound |
| Prime Lake | 13.00–13.25 | 13.00–13.25 |
| Electrolytic | 12.87½ | 13.00 |
| Casting | 12.62½ | 12.62½ |
| Wire, base | 14.00 | 14.00 |
| Lead, Am. S. & R. price | 4.70 | 4.70 |
| Antimony | 4.20 | 4.15 |
| Nickel, ingot | 41.00 | 41.00 |
| Sheet zinc, f.o.b. smelter | 8.00 | 8.00 |
| Zinc, spot | 4.97½ | 5.00–5.05 |
| Tin, straits | 29.00 | 28.87½ |
| Aluminum, 98 to 99 per cent | 19.10 | 19.10 |
| **OLD METALS** | | |
| Heavy copper and wire | 11.00–11.25 | 11.00–11.25 |
| Brass, heavy | 5.00 – 5.25 | 5.00 – 5.50 |
| Brass, light | 4.37½– 4.62 | 4.75 – 5.00 |
| Lead, heavy | 3.75 – 3.87½ | 3.75 – 3.87½ |
| Zinc, old scrap | 2.25 – 2.50 | 2.25 – 2.50 |

# THE WEEK
## IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A SLIGHT improvement in jobbers' sales is reported for the last week, and it is hoped that this is the beginning of the spring demand upon which many hopes have been pinned. In the Southeast good seasonal business is experienced whenever there is a let-up in the bad weather conditions. St. Louis jobbers have had good sales of meters, distribution transformers and other pole-line material. Employment there increased 3 per cent in February. In New England jobbers are selling more, though the small order still rules; demand for meters there is 20 per cent ahead of last year at this time and 25 per cent more turbo-generators have been sold since Jan. 1, 1922, than during the same period of 1921. San Francisco has experienced unusually cold weather, and while this has made for a successful heating pad season, it has retarded other sales. Gains in both general and electrical trade are reported from the Northwest.

News comes from Washington that the army appropriation bill as reported to the House by the appropriations committee provides $270,000 for electrical installations and searchlamps at seacoast defenses next year, an increase of $205,000 over funds allowed for the current year. For electrical installations on Hawaiian coast defenses $120,000 is provided.

## NEW YORK

The volume of business in the electrical trade shows slight improvement over last week. Orders for wiring supplies are coming through at the same steady rate, but for the most part they are for comparatively small quantities and the buying is still of a hand-to-mouth nature. New buildings in the residential sections of outlying districts are chiefly responsible for the present demand for wiring supplies. This promises to increase shortly as a considerable amount of home building is planned for this year. Continued favorable weather will hasten the development of this business.

Industrial business as yet shows few signs of actual revival, but one jobber, who specializes in this kind of equipment, stated that he is receiving an increasing number of inquiries from this class of customer. This, at least, can be taken as an indication that renewed activity in industrial lines is not so far off.

No important price changes were reported this week, although price competition on some items is very much in evidence. The appliance business, except for the keen demand for radio equipment, is very quiet.

**Rigid Conduit.**—Jobbers' stocks are good in all the usual sizes, and prices remain unchanged. The following prices were quoted this week: For ½-in. black pipe in 2,500-ft. lots, $44 to $45; ¾-in., $57 to $58, and 1-in., $82 to $83 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $49 to $50, $64 to $66 and $91 to $93 per 1,000 ft. Demand is spotty and most sales are in small quantities.

**Rubber-Covered Wire.**—Prices and conditions in the wire market show no change since last week. No. 14 rubber-covered is quoted at $6.25 to $6.35 per 1,000 ft. in 5,000-ft. lots. Stocks are fair to good.

**Flexible Armored Conductor.**—Prices for this material were rather unsteady this week without any actual change in quotations, although some price cutting has been reported. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft. and double-strip at $45 per 1,000 ft. in that quantity.

**Lamp Cord.**—Demand is spotty and jobbers report little movement of either cotton or silk cord. No. 18, cotton, twisted, is quoted from $11.65 to $12.75 per 1,000 ft. in that quantity. No. 18, cotton, parallel, is quoted at $14.50 to $15.45 per 1,000 ft.

**Tape.**—This material is moving in line with other wiring supplies. Both friction and rubber sells for 36 cents a pound in 100-lb. lots.

**Appliances.**—Activity in heating devices has been very limited. Vacuum cleaners are moving fairly well and the sale of washing machines is also beginning to show improvement.

**Radio.**—Demand for radio apparatus is unabated, but stocks in the hands of electrical jobbers are virtually nil. Department stores and sporting goods houses have received some complete outfits as they appear to have "got the jump" on the electrical trade in sensing the possibilities of this business and were first in line with their orders for the new wireless apparatus.

## CHICAGO

The electrical trade has reported price reductions this week on flush receptacles and gang boxes. The demand for wiring materials has been spasmodic, most jobbers reporting a fair action on rubber-covered wire with a good movement of the flexible armored conductor. A variation in the price of conduit has also been noted, which would seem to indicate that prices are being shaded in order to start a movement on this material. Several good orders for high-tension equipment were reported by manufacturers.

**Wire.**—The market for rubber-covered wire has been fair during the past week with few large calls for the No. 14, which sells for $6.25 to $6.30 per 1,000 ft. in 5,000-ft. lots. Stocks are ample. The demand for bare and weatherproof wire has been on a steady basis, but no price changes have been reported. The price of weatherproof wire varies around 16½ cents a pound, depending upon conditions of sale. The bare wire sells for the same price. Stocks of both commodities are fair.

**Flexible Armored Conductor.**—The steady business in this material has lowered most dealers' stocks so that they are ordering again from manufacturers. The No. 14 two-wire, single-strip conductor sells for $45 per 1,000 ft. in 5,000-ft. lots.

**Conduit.**—The keen price competition is varying prices on the ½-in. black pipe from $40 to $42.25 per 1,000 ft. in 5,000-ft. lots. However, the call for this material has not been strong. Stocks of the majority of dealers are good.

**High-Tension Equipment.**—Two 600-kw., 22,000-volt outdoor substations were sold during the week by one company to a central station in the Northwest. They also shipped an order for 600-volt heavy-duty plug receptacles to St. Louis. Another company has sold 2,300-volt switching equipment to a Central Western utility. Outdoor disconnecting switches, lightning arresters and fuses rated at 50,000 volts were sold to a Oklahoma utility by another company.

**Flush Receptacles.**—Prices on this line have been lowered so that the single receptacle now sells for 25 cents in lots of 100. The duplex type is quoted at 37 cents in lots of 100. The movement is only fair and stocks are ample

**Porcelain.**—The demand for porcelain has been growing along with the upward trend in the radio line. "Nail-it" knobs sell for $17 per 1,000 in barrel lots. The ⅝-in. x 3-in. tubes are obtainable for $6.90 per 1,000, also in barrel lots.

**Gang Boxes.**—A price reduction has increased the discount to 55 per cent, and dealers report a fair market.

**Radio.**—This line continues to be the one center of attraction, but the demand far exceeds the supply. The public seems to be willing to buy almost any kind of equipment just as long as it is an apparatus that will operate.

## BOSTON

Despite the retarding effect of the strike in the cotton textile areas of New England, business shows some improvement in the electrical field. Small-order transactions rule in buying, but the volume of these tends to increase. Deliveries are excellent except in radio apparatus, which is in such great demand as to crowd existing factories hard and much overtime work is being done. Prices underwent few changes of consequence last week, although motors are somewhat weaker and various readjustments were recorded in the jobbers' price sheets sent into the sales field. In the building and engineering field over $5,000,000 worth of work was placed in the latest week reported by the Dodge organization, or far ahead of most corresponding weeks for the past twenty years. The Federal Reserve Bank states that building costs have now decreased to a point where they bear the same relation to rents as in 1913, so that nearly a pre-war return on the investment can be obtained.

**Motors.**—Business is spotty, with a very fair volume of inquiries and a good deal of application engineering under way. The recent price reduction of 8 to 10 per cent has not apparently started up any material increase in demand. Interest is evident in fractional-horsepower sizes.

**Wire.**—Demand is moderate with easy deliveries. Rubber-covered No. 14 is moving at $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof base early in the week was 15½ cents. Little bare wire is moving at present.

**Radio Apparatus.**—Local manufacturers are pushing production hard, and increased facilities are being planned in some quarters. A genuine boom is under way in this branch of the industry, and interest in broadcasting increases weekly. Public utilities are beginning to study the possibilities of radio telephony for operating service, but few installations have as yet been made in this district.

**Storage Batteries.**—Batteries for automobile starting and lighting service are moving well, and business is much better than it was two months ago.

**Turbo-Generators.**—Since Jan. 1 New England central-station companies have purchased from a single maker about 50,000 kw. in steam turbo-generators, or 25 per cent above the corresponding period last year. Plans for additional central-station development are being considered.

**Flexible Armored Conductor.**—Moderate sales are reported, No. 14 single-strip moving at $45 per 1,000 ft. in 1,000-ft. lots to 2,500-ft. lots. Good stocks are in hand.

**Meters.**—The demand is better than last year at this time by about 20 per cent, according to a representative producer. New mercantile building operations are absorbing a few of the larger units, but residential services are pulling hardest on stocks. Central-station outputs are increasing substantially over last year's figures in noteworthy cases, and house-wiring campaigns at Worcester and Providence are yielding excellent results.

**Appliances.**—Smaller devices are moving fairly well, and some demand is evidently growing for the larger labor-saving outfits. One jobber sold two carloads of washers last week. Interest in cleaners is picking up somewhat, and jobbers are beginning to order fans.

## ATLANTA

Although a slight improvement is reported by the jobbing and other business interests in the section, business activities have not come up to the point that was anticipated, owing undoubtedly to the unfavorable weather which has existed for the last thirty days. It has been almost impossible to undertake and carry on with any degree of continuity out-door work of any kind, with the result that a great many of the building projects undertaken at the first of the year have progressed very little. This is reflected in the slackened demand for electric building material, lumber, brick and hardware lines and has served further to increase non-employment. Business, therefore, has been unable to show the normal increase to be expected at this season of the year. Taking the district as a whole, the valuation of building permits for January and February, 1922, compares favorably with the figures for the same period of 1921. While delayed, the building activities will get under way as soon as conditions will permit, and this will serve to improve sales in all lines. In the lines of manufacture it is reported that the overall manufacturers have sufficient orders in hand to continue operations for several weeks, with cotton hosiery showing but little change for the past ninety days. Brick and lumber products also show little change, while furniture manufacturers are on about 75 per cent capacity.

**Lighting Fixtures.**—Industrial types and the better class of commercial fixtures are moving quite satisfactorily, with an anticipated brisk demand for residential equipment. Stocks are in good shape with no recent change in prices.

**Vacuum Cleaners.**—This specialty has not responded to the expected spring demand, dealers hesitating to order in quantities for stock until conditions better themselves. Jobbers' stocks are good to heavy, with prices steady.

**Insulators.**—A fair demand in certain localities for insulators of the high-tension type is reported, but low-tension porcelain insulators are somewhat slow. The glass telephone type continue to move satisfactorily, with good stocks throughout the section.

**Conduit.**—Pipe continues a steady movement, the ½-in. type at present being the most popular, with an increasing demand in all the popular sizes, both black and galvanized, to be noted.

**"Nail-It" Knobs.**—A price reduction of 15 per cent is to be noted, effective last week, with the demand only fair. Jobbers have accumulated quite respectable stocks in the porcelain lines.

**Safety Switches.**—Safety switches continue very active as additional municipalities require them for all new installations. The 30-amp. two-wire and three-wire continue to lead in popularity, though all sizes up to 100-amp. three-pole are fast movers. Stocks of all sizes are good.

**Cut-outs.**—Cut-out prices have been reduced 10 per cent since last week. Sales are reported only fair because of inability to complete construction work recently started.

## ST. LOUIS

Some improvement in sales was experienced by jobbers here last week, reflecting the general increased activity as spring approaches. Meters, distribution transformers, poles and cross-arms are being purchased in greater amounts by the central-station companies, indicating that an increase in load is expected, which will result in improved sales of electrical goods generally. Municipal extensions are dormant pending the spring elections, most of which will be held next month. Motors and other industrial goods show continual improvement in demand, and the call for wiring supplies is at least being steadily maintained.

Industrially and commercially the situation in this territory is somewhat improved. Employment is reported to have increased about 3 per cent in February over January, but non-employment still exists in virtually every line of endeavor except that of shoe manufacture. Several of the steel plants and iron foundries are now operating at about 50 per cent of capacity. Construction work is increasing in volume, and building wages are gradually declining. The ironworkers accepted a 15 per cent reduction last week, and the sentiment on the part of the other trades toward wage reductions is becoming more favorable. The buying power in this territory is gradually bettering as conditions in agriculture, the basic industry, become improved. The prices of farm products have increased about 20 per cent in the last six months, and the farmer should be in much better financial condition when this year's crops are harvested.

**Porcelain.**—Prices are materially reduced. Stocks are in good shape and the demand is steady, with slight improve-

ment from week to week. "Nail-it" knobs are being sold for $15 per 1,000 in barrel lots. The 5/16-in. x 2½-in. tubes are priced at $3.75 per 1,000 in barrel lots, and the 5/16-in. x 3-in. tubes at $4.50 per 1,000. Two-wire and three-wire unglazed cleats sell for $10.70 per 1,000 in barrel lots, and 5½-in. split knobs for $10.70 per 1,000 in barrel lots. Leather nail heads are quoted at 35 cents per 1,000 in lots of more than 25.

**Fuses.**—A leading manufacturer reports that business is running about 40 per cent greater than this time last year. All jobbers report that the demand has been unusually good considering industrial conditions. Stocks have been weak but now are generally in good shape. Clear-window plug fuses sell from $2.75 to $3.65 per 1000 in lots of 1,000 or more. For orders of from 200 to 1,000 the price varies from $3 to $4 per 100.

**Rigid Conduit.**—The following prices obtain: ½-in. black, $4.35 per 100 ft.; ½-in. galvanized, $4.95 per 100 ft.; ¾-in. black, $5.50 per 100 ft.; ¾-in. galvanized, $6.30 per 100 ft. Stocks are in good shape, and the demand, while slow, is steady.

**Conduit Boxes.**—Typical quotations are as follows: 3½-in. octagon black, $7 per 100; 3½-in. octagon galvanized, $8 per 100; 4-in. octagon black, $8.50 per 100; 4-in. octagon galvanized, $9.50 per 100.

**Lock Nuts and Bushings.**—Prices are about 10 per cent lower. Representative quotations, in lots of 100, per 100, are: ½-in. lock nuts, 54 cents; ½-in. bushings, $1.35; ¾-in. locknuts, 78 cents; ¾-in. bushings, $1.80. Stocks are reasonable in size, considering the comparatively slow demand.

**Wire.**—The demand is virtually unchanged, by far the greater portion of the sales being of No. 14 rubber-covered. Quotations on solid, single-braid rubber-covered are about as follows, per 1,000 ft. in 5,000-ft. lots: No. 14, $6.25; No. 12, $8.50; No. 10, $11.25; No. 8, $15.05.

## SAN FRANCISCO

The general trend of business is one of slow but steady improvement. Of course, there are occasional slight retrogressions and perhaps this past week may be considered one of them. Competition has never been so acute and constructive. In this district at least it has long recovered from the easy-order period of war times.

**Weatherproof Wire.**—Triple braid base sizes are being quoted in coil lots at $20.50 per 100 lb. with 1 cent per pound increase in 500 lb. lots. Local stocks are low on sizes No. 2 to No. 8 inclusive, with a steady distribution line demand from the power companies. Lower prices are being quoted on No. 14 single-braid solid rubber-covered. Quotations as low as $6.50 per 1,000 ft. in 2,500-ft. assorted lots have been reported, and special prices on application are made on $500 net assorted shipments.

**Farm Plants.**—The slight improvement noticed last fall has slumped to a poor sales volume, probably because former agents have drifted away to new fields. It is confidently expected that the distribution of the next crop will aid demand.

**Porcelain.**—This material is still in a state of flux, "nail-it" knobs being generally quoted at $18 per 1,000 in packages and 5/16-in. x 3-in. tubes at $5 per 1,000 lots. The demand is excellent. Jobbers' stocks are just now rather low but with good shipments en route.

**Conduit Fittings.**—New prices on bushings and lock nuts are being quoted in accordance with the present policy of giving as far as possible maximum prices on minimum orders. Sizes ½ in. to 1 in. inclusive are being quoted in cartons at about $1.50 per 100 on the ½-in. bushings and 65 cents per 100 on the lock nuts. The 1-in. sizes are quoted respectively at $3.70 and $1.50 per 100.

**Conduit.**—Conduit is unchanged from previous quotations. The call is very good. Local stocks are in good shape.

**Heating Appliances.**—Jobbers' sales of small appliances are improving. The public demand is a little better, but sales have been cut down because of cold weather, which is very unusual for California. Occasional normal days show bursts of selling. Heating pads, of course, have had perhaps their best season, with occasional shortages. Small flatirons in the 3-lb. and 1½-lb. size have been very popular. Small open-disk stoves, too, are very popular, not so much on account of lower prices as of better merchandising.

**Sewing Machines.**—From now until after Easter sales may be expected to improve considerably, although the market will not be stabilized until unsold machines of makes now retired from the market are disposed of. Such machines are usually quoted net at about $50 for the rotary style, whereas $75 is the average retail price for standard makes.

## PORTLAND—SEATTLE

That the Pacific Northwest is coming back in a business way is clearly indicated by reports of bank clearings for the past two weeks. The clearings for Seattle for the week ended March 13 showed a gain of 28 per cent over the corresponding week of a year ago. Similar figures for the week ended March 2 showed a gain of 24 per cent over the year previous. Other cities in the Northwest all showed substantial gains over 1921 for the same weeks. Logging and lumbering continue to gain somewhat, both in the number of men employed in the industry and in the amount of business transacted.

Expenditures for highway construction throughout the State of Washington which will begin soon will total more than $1,750,000. This will furnish employment to a considerable number of men. Shipments of wheat from Portland are materially increasing this month. In the electrical trade some improvement in business is noted. One jobber with branch offices up and down the Coast has been carrying on an extensive advertising and educational campaign, the purpose of which is to educate home owners and contractors to the necessity for better wiring in order to secure maximum service from the completed installation. It is claimed that in an effort to meet the demand for cheap installations the number of convenience outlets installed has been kept down to not over one-half of the number necessary to get the best service. Results of the campaign are already becoming apparent.

Residence construction both in the city of Portland and in the surrounding country is very active, and jobbers report sales of rubber-covered wire, conduit and other wiring material as improving materially. The demand for radio equipment continues very active. There has been a slight drop in plug cut-outs and porcelain articles. Inquiries relative to new business are good.

Contractors generally throughout Oregon report business to be very slack, but with the large amount of projected building which will undoubtedly be started soon these conditions should mend in a very short time.

## SALT LAKE CITY—DENVER

Coincidental with the development of road building projects to be launched soon in the Intermountain region, keen interest is being shown in electrical installations for highway illumination. The success attained in using high-power reflectors at dangerous curves and crossings has suggested the feasibility of lighting entire paved highway systems. It is believed that the power rate in this region would not make it at all prohibitive.

Although the money market is slowly easing, many electrical dealers throughout the Intermountain territory are still seriously handicapped by a very limited credit standing with jobbers, a condition that keeps the volume of sales at a low mark. There is a good demand for money for home building, with the banks in a fair position to handle well-secured loans. Builders' hardware and lumber are showing a decided pick-up with the near approach of spring.

**Washing Machines.**—The big drive continues on washers. Intensive competitive selling is having the effect of lowering retail prices. One well-known cylinder machine is now advertised at a reduction of $42.50. The volume of washer sales is good.

# Manufacturers' Activities

**Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature**

## General Electric Buys Western Factory Site

Another Western factory branch in the electrical field is seen in the announcement by the General Electric Company of the purchase of approximately 24 acres of land in East Oakland, Cal. The company states that no definite plans for the use of this site have been formulated, but it is understood that the property will be improved in line with the extension of manufacturing activities in Oakland.

For about ten years the company has manufactured "Mazda" lamps in its Oakland factory. It announces at the present time its confidence in the future of the Pacific Coast and that, looking toward this future growth, certain of its products will be made there.

## Wireless Specialty Company Seeks New Home

The Wireless Specialty Apparatus Company, South Boston, Mass., has leased a five-story modern reinforced-concrete factory on Atherton Street, in the Jamaica Plain section of Boston, and will move into its new quarters about April 15. Increasing demand for radio equipment and the need of obtaining better facilities for quantity production led to the change. Soon after moving, more than twice the floor space at present utilized will be occupied in radio-equipment production, and ultimately about five times the present floor area will be employed. The company is carrying on investigations in the static-condenser field for power-factor correction in addition to its radio-equipment production.

## New Plant for Electrical Foundry & Equipment

A new plant, estimated to cost about $200,000, including machinery, is now being constructed at Tacony and Bleigh Streets, Philadelphia, for the Electrical Foundry & Equipment Company. It will specialize in steel castings, with facilities to manufacture castings up to 200 lb. William P. Cunningham is president.

## Gurney Elevators to Be Made by Brooklyn Company

The American Machine & Foundry Company has acquired a substantial interest in the Gurney Elevator Company, it is announced, and hereafter Gurney elevators will be manufactured in the plant of that company in Brooklyn, in addition to the Gurney Elevator Company's plant at Honesdale, Pa. This arrangement was brought about to provide increased manufacturing facilities for the growing business of the Gurney Elevator Company, partly because of its entrance into the field of high-speed gearless elevators. With these added facilities the Gurney Elevator Company will have one of the largest elevator manufacturing plants in the country.

## Graton & Knight Increase Production Schedule

Improved business conditions have led to the establishment of a fifty-hour week at the plant of the Graton & Knight Manufacturing Company, Worcester, Mass. J. R. Fox, sales manager, informed the ELECTRICAL WORLD recently that, although no boom has occurred in the demand for belting, a better tone is evident in sales and that orders are coming in at an improved rate from the East and South. The Middle West is still quiet. About 1,000 employees are now on the company's payroll.

## Federal Trade Commission Dismisses Western Electric Complaint

The Federal Trade Commission has dismissed the complaint against the Western Electric Company, alleging unfair competition and violation of the tying-contract provision of the Clayton law.

The complaint against the Western Electric Company, which is understood to be the principal manufacturing agent of the American Telephone & Telegraph Company, was considered as far back as Jan. 5, 1921. Now it appears that legislation passed by Congress on June 10, 1921, affecting the consolidation of telegraph companies has made it uncertain that an effective order could have been issued in relation to the complaint against the company. One construction of this law is that it permitted in the consolidation of telephone companies acts which might otherwise have been looked on as violations of the Sherman law. The opinion has been expressed that where such consolidations by the telephone interests have been made legal it would be difficult to control the manufacturing interests involved.

In a statement issued to the press, the Western Electric Company states that the attorney of the commission after a thorough investigation lasting fourteen months failed to find any facts which would substantiate the original charges.

# Results of Geier Company Price Questionnaire

### Large Majority of Company's Dealers Against Any Substantial Cut as Dangerous to Sales Volume—Say Public Will Pay Fair Prices

There will be no change at the present time in the price of the vacuum cleaner manufactured by the P. A. Geier Company, Cleveland, as the result of a questionnaire on the subject of prices sent out to its dealers a short while ago and noted in the ELECTRICAL WORLD at the time. A large majority of the dealers queried replied that more business could be done at the present price of the appliance than could be done were a substantial cut to be made. The exact feeling of the dealer in the matter of price is shown in an article by F. J. Gottron, sales manager of the company, in the latest issue of the company's house organ, which reads in part as follows:

"More than 69 per cent of the distributers, dealers and salesmen who replied to our questionnaire asking whether the price of Royal cleaners should be reduced have either suggested such a very slight concession that it would not affect the situation or else they came out emphatically, 'Don't change the price.' And since these dealers not only were in the majority as to numbers, but because they also represent more than 75 per cent of the sales, we are accepting their judgment as our guide. 'No price change' is the verdict of a jury of our most experienced and successful sales outlets. About 12½ per cent of Royal dealers, however, suggested a substantial cut. We studied these returns carefully with a view to finding exactly what lay behind their advice. In most cases we found just one reason—the fear of lower price competition. 'Other cleaners have reduced prices, and lots of people who want Royals are waiting for the Royal to reduce also,' is a characteristic explanation of this group of dealers.

"When people insist that they want lower price, many manufacturers and retailers commit the error of thinking that these people want cheaper merchandise. Not at all. The demand for lower price is based upon the conviction that the prevailing price is too high for the value of the merchandise. But that they will not pay $2 for a 25-cent article does not mean that they will refuse to pay $2 for an article worth 200 cents. You'll notice that the price of Liberty bonds, which went down when people were wasting their money, are now quoted around par when people are insisting on value. This great underlying truth, that the public will pay a fair price if it is given fair value, is the foundation of successful business."

## Form New Jobbing Company

The Twin Cities Electric & Supply Company, Menasha, Wis., has discontinued its contracting business and will engage in the wholesaling of electrical supplies and equipment and mill supplies. The company was established in 1917 for the purpose of retailing electrical supplies, but found there was such a large field in the jobbing, contracting and milling supply branch of its business that it was decided to devote all of its attention to those lines. As an aid in handling this business the company has incorporated a subsidiary, the Wisconsin Electric Appliance Company, with a capital stock of $75,000. Plans are being made to open another establishment in Wisconsin. The officers of the company are: G. E. Lewis, president; H. E. Bullard, vice-president; V. M. Gombert, secretary-treasurer.

## Savage Arms to Make Washing and Refrigerating Machines

Plans are under way, according to officials of the Savage Arms Corporation, 50 Church Street, New York, for that company to go into the production of electric washing machines and refrigerating machinery and parts. The company has plants at Utica, N. Y., and at Pittsburgh and for many years has been engaged in the manufacture of firearms and ammunition. Final plans for the entrance of the company into the electrical field have not been made as yet, and it will probably be several months before either of the plants will be ready to go into production of the new lines.

It is announced also that the Chicopee (Mass.) factory of the Westinghouse Electric & Manufacturing Company, which was used in the production of small armament during the war and operated under the same supervision as the plant at East Springfield, Mass., has been sold for $1,500,000 to the Savage Arms Corporation. The East Springfield factory was converted after the war to the requirements of peacetime production, and an article describing the electrical distribution and power problems of this transformation was published in the ELECTRICAL WORLD for Sept. 20, 1919, page 620. The East Springfield factory is now devoted to the production of electrical equipment for automobile starting and lighting, small motors, and radio apparatus under the direction of A. B. Reynders, works manager.

## Whiting Corporation Announces Branch Changes

The Whiting Corporation, manufacturer of electric traveling cranes, Harvey, Ill., has established a branch office in New York City at 136 Liberty Street, having discontinued its agency agreement with Wonham, Bates & Company, who formerly had the Eastern representation of the company. J. Ross Bates, one of the vice-presidents of the Whiting Corporation, is in charge of the new office. He is to be assisted in the New York territory by D. Polderman, Jr., and in the New England States by R. C. Maley, who will open an office at Springfield, Mass. These three men were formerly associated with Wonham, Bates & Company. Another branch office has been opened in Indianapolis at 305 Merchants' Bank Building, in charge of S. E. Stout, who was formerly at the main office, Harvey, Ill. This office will have charge of the business in southern Indiana and adjoining cities in Ohio and Kentucky. The Detroit office of the company has been moved from the Penobscot Building to 206 Stahelin Building.

## Refractories Manufacturer Established

The Keystone Refractories Company has been formed with offices at 120-122 Liberty Street, New York, to manufacture high-temperature cements and granular refractories. The company will have a factory in Jersey City. F. W. Reisman, formerly traveling sales manager of the Quigley Furnace Specialties Company, is president and general manager, and L. E. Turk, formerly treasurer of the Quigley company, is secretary and treasurer.

## Balancing Machine Manufacturer Wins Patent Suit

Decision has been rendered for the plaintiff in the United States District Court for the Eastern District of Pennsylvania, according to the Tinius Olsen Testing Machine Company, 500 North Twelfth Street, Philadelphia, in the suit brought by that company against the Vibration Specialty Company and Nicholas Akimoff for infringement of patents owned by the Olsen company. The defendants in that suit, T. Y. Olsen, vice-president and treasurer of the Olsen company, says, are now under injunction, and an accounting for damages and profits has been ordered.

## International Combustion Notes Increasing Foreign Demand

World-wide demand for the products of the International Combustion Engineering Company, New York, and its foreign subsidiaries is indicated by dispatches recently received from London showing that in December the company received contracts for installing stoking equipment in almost every large construction project undertaken in England. This included equipment for new power houses at Belfast, Ireland, and Nottingham, England, and for the Morwell power station, Melbourne, Australia—three contracts which alone total close to $420,000 worth of business at normal exchange rates. The company also has just received a large order for stokers and ash conveyors for India and is working on another large project for Johannesburg, South Africa. The officials of the London subsidiary report that the present outlook for new business is better than it has been in several years.

## Westinghouse to Erect St. Louis Warehouse

Plans have been announced whereby the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., will consolidate its St. Louis warehouse, service shop and offices in a new building which is to be erected for it at Twelfth and Gratiot Streets, at a cost of about $150,000. According to J. S. Tritle, manager of the St. Louis branch, the new building, which will be a three story, reinforced-concrete structure, will allow the company to expand its St. Louis business and will result in the employment of about sixty more men. Provision will be made for the erection of two additional stories later if needed. In the new quarters the company plans to enlarge the service department and to include the manufacture of panelboards.

**McClellan & Junkersfeld, Inc.,** consulting engineers, have announced that permanent headquarters have been established at 45 William Street, New York. The formation of the organization, headed by William McClellan, Peter Junkersfeld and Horace T. Campion, was described on page 348 of the Feb. 18, 1922 issue of ELECTRICAL WORLD.

**The Autovent Fan & Blower Company,** manufacturer of ventilating fans and blowers, Chicago, has opened a direct factory branch office in Cleveland at 508 Fidelity Mortgage Building. L. B. Dewey, formerly with the Westinghouse Electric & Manufacturing Company has been appointed manager.

**The Dominion Engineering Agency,** 24 Adelaide Street, East Toronto, Canada has been formed to represent manufacturers in the Canadian territory. The company is now the representative of the Cutter Electrical & Manufacturing Company and Schweitzer & Conrad, Inc. Daniel M. Fraser is president of the company.

**William R. Noe & Son,** manufacturers of lighting fixtures, 43 East Tenth Street New York, have purchased 16,000 sq.ft. of property at Willoughby Avenue and Raymond Street, Brooklyn. Plans are being prepared to improve the property with a three-story reinforced concrete factory for their own occupancy.

**The Yale & Towne Manufacturing Company,** Stamford, Conn., has transferred C. H. Pearson and C. B. Veit, formerly district managers, in the New England and Chicago territories respectively. Mr. Pearson will cover Arizona, Colorado, California, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, Wyoming, Alberta and British Columbia. Mr. Veit will cover New England, and in Canada the territory east of Montreal, including New Brunswick, Nova Scotia and Prince Edward Island, as well as Newfoundland. Both Mr. Pearson and Mr. Veit have been with the Yale & Towne organization about fifteen years.

## Foreign Trade Notes

ELECTRICAL DEVELOPMENTS IN AUSTRALIA.—A bill authorizing the Lawson Ministry to borrow £2,000,000 for the purpose of carrying out the projects and undertakings of the State Electricity Commission of Victoria, *Electrical Industries* states, has been approved by the Victorian House of Assembly. Practically all tenders have been awarded for the larger sections of the electricity scheme.

POWER DEVELOPMENT OF THE RIVER RHONE.—A report from Commercial Attaché W. C. Huntington at Paris to the Department of Commerce contains detailed information regarding the harnessing of the River Rhone for power, navigation and irrigation purposes. An outline of France's wealth in waterpower is given, with particular reference to the River Rhone as the most important source of potential hydro-electric power in France. The total cost of the proposed developments is placed at 1,848,000,000 francs. The financing of this project will be accomplished by a gradual carrying out of the entire scheme, extending over a period of years. Copies of the above report and of the law authorizing the power development, etc., may be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, or from the bureau's district offices, by referring to Exhibit No. 1178.

ELECTRIC EQUIPMENT FOR CALCUTTA, INDIA. — At a meeting held Jan. 25 the stockholders of the Calcutta Electric Supply Corporation, Ltd., according to *Commerce Reports*, decided to expend £500,000 for additional power equipment to extend its service. The equipment loan is to be facilitated by a loan from the treasury and by a guarantee on behalf of the government of both capital and interest.

CHILEAN RADIO CONTRACT INEFFECTIVE. — The contract entered into between the government of Chile and the Siemens-Schuckert Company, the American Embassy, Santiago, Chile, has informed the Department of State, will become ineffective at the termination of the present session of the Chilean Congress, on or about April 1 through lack of an appropriation. New bids will then be invited and proposals from American firms will be welcome. The contract with the Siemens-Schuckert Company called for the installation of eleven radio stations, which were to be of the Telefunken type and would cost 1,385,000 gold pesos of 18d. ($505,525 at par of $0.365). The above contract caused considerable objection because it called for a change from the Marconi type, with which all wireless stations of Chile are equipped, to the Telefunken type.

AMERICAN FIRMS LOSE NEW ZEALAND ELECTRIC CONTRACTS.—Owing to the effects of the adverse rate of exchange, combined with the New Zealand government's avowed policy of giving preference to British manufacturers wherever possible, the *Journal of Commerce* states, the contracts for the Mangahao hydro-electric station were awarded to a British company, although the tenders submitted by the National Electric Company, which handles the business of the General Electric Company in New Zealand were lower than those of the English company. The prices in question were as follows: For generators—accepted, British, £54,968; rejected, American, £40,000; transformers—accepted, British, £16,574; rejected, American, £15,500; difference in price in favor of American tenders, £16,192. Quality was not in question. The American quotation was at $4.20. The National Electric Company strongly protested against this preference, pointing out that while it was accustomed to reckon that 10 per cent preference was the usage, this was a case, as to generators, of 37½ per cent. It was also pointed out that the products of the General Electric Company were already in extensive use in the various electric undertakings and had been specified by the government engineers, irrespective of price. Moreover, they were popular throughout New Zealand in public and private plants. The answer of the Minister of Public Works was: "With regard to settlement of public tenders particular stress is laid on preference to British goods, especially in view of financial relations and the shipping position existing between this dominion and the mother country at the present time. It would not, however, be correct to infer that no tender other than British would be considered, irrespective of price." The matter was raised in Parliament when the American tenders were mentioned. The Minister then said the government preferred where possible to give preference to British goods made by British workmen. A contract for lightning arresters was obtained by the National Electric Company.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile corporation in Austria (No. 1,057) desires to obtain a forwarding agency for the sale of electrotechnical articles, tools of all kinds, etc.

A manufacturing firm in Spain (No. 1,059) desires to purchase small electrical supplies, pistol-shaped flashlamps (enameled back) and storage batteries. An agency for the sale of these goods is also desired.

A firm of hardware merchants in Canada (No. 1,062) desires to obtain an agency on commission for the sale of electrical novelties, etc.

Agencies are desired by an importer in Australia (No. 1,076) for the sale of electrical goods, specialties and motor accessories.

## New Apparatus and Publications

WATER HEATER.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has placed on the market a small electric immersion waterheater, designed to heat a small quantity of water quickly. The voltage of the heaters is from 110 to 120 and the wattage is 350.

STOKER.—The Combustion Engineering Corporation, New York City, is distributing a leaflet describing its type K automatic stoker.

PULVERIZED FUEL.—The Hardinge Company, 120 Broadway, New York City, is distributing catalog No. 12, which describes the preparation, transportation and burning of pulverized fuel as obtained by the Quigley fuel system, manufactured by this company.

LIGHTING FIXTURES.—The Mid West Chandelier Company, Kansas City, Mo., has issued catalog No. 10, describing and illustrating the line of lighting fixtures manufactured by it.

MOTORS.—The Baldor Electric Company, 4,351 Duncan Avenue, St. Louis, has prepared Bulletin No. 3, describing its type R repulsion induction electric motors.

INSTRUMENTS.—The Pyrolectric Instrument Company, Trenton, N. J., is distributing catalog No. 19, containing information upon its electrical precision instruments, hydrogen-ion apparatus, laboratory accessories, pyrometers and electric furnaces.

MOTOR.—The France Manufacturing Company, Berea Road and West 104th Street, Cleveland, has recently placed on the market an ½-hp. "F-F" synchronous motor.

SIGNAL SYSTEM.—The Connecticut Telephone & Electric Company, Meriden, Conn., has recently placed on the market a complete hospital nurses' silent-call system.

WASHING MACHINE.—The Blackstone Manufacturing Company, Jamestown, N. Y., has placed on the market an electric washing machine, under the name of the "American Classic."

TEST UNIT.—The Beehler Electrical Equipment Company, Yuma, Col., has recently placed on the market a motor and generator testing unit.

## New Companies

THE JENNINGS (LA.) UTILITIES COMPANY has been incorporated with a capital stock of $75,000. The officers are: Fred I. Getty, president; J. O. Modisette, vice-president, and D. E. Nims, secretary and manager.

THE WILLOUGHBY (OHIO) LIGHT & POWER COMPANY has been incorporated by R. W. Russell, L. E. Peck, Winfield Worline, W. A. Steong and J. L. Donnelly.

THE NEBO (KY.) LIGHT COMPANY has been incorporated with a capital stock of $3,000 by L. J. Morrow, J. W. Stevens and J. H. Herron.

## Record of Electrical Patents

**Notes on United States Patents**

(Issued Feb. 21, 1922)

1,407,313. APPARATUS FOR ELECTROLYSIS; Edward A. Allen, Portland Me. App. filed Feb. 15, 1919. For decomposing compounds by electrolysis.

1,407,353. TROLLEY; Louis T. Outhier, Eureka, Cal. App. filed June 4, 1921. Trolley-pole wheel fastened on rocker arm.

1,407,363. RECTIFIER; Russell T. Walker, Chicago, Ill. App. filed June 28, 1920. For single-phase alternating current.

1,407,383. METHOD OF OPERATING STORAGE BATTERIES, ETC.; John L. Creveling, Auburn, N. Y. App. filed July 13, 1915. Automatic charger.

1,407,386. DRY CELL; Henry R. Dam, Brooklyn, N. Y. App. filed June 21, 1920. Electrodes are separated while inactive.

1,407,420. EXTRACTION AND RECOVERY OF COPPER; Noak V. Hybinette, Ottawa, Ontario, Canada. App. filed Feb. 15, 1921. Electrolyzing roasted ore with sulphuric acid.

1,407,430. ELECTRIC IRON FITTED WITH A CURRENT INDICATOR; George H. Lofts, Hobart, Tasmania, Australia. App. filed Sept. 21, 1920. Indicates when power is on.

1,407,489. PRIMARY BATTERY; William M. Shakespeare, South Orange, N. J. App. filed May 6, 1920. Means for indicating energy available.

1,407,508. ELECTRIC MOTOR; Vincent G. Apple, Dayton, Ohio. App. filed Aug. 6, 1919. Sewing-machine motor.

1,407,527. ELECTRIC FIXTURE FITTING AND METHOD OF MAKING SAME; David Goldich, Winsted, Conn. App. filed Aug. 27, 1920.

1,407,564. APPARATUS FOR DISPLAYING LIGHT ADVERTISEMENTS; Bertel A. Nielsen, Kvissel, Denmark. App. filed Nov. 11, 1919. Stereopticon lantern with rotating disk.

1,407,572. TELEGRAPH TRANSMITTER; Charles Phillips, Jr., Philadelphia, Pa. App. filed Oct. 18, 1920. Operated as a typewriter.

1,407,604. REPEATER CIRCUIT; John F. Toomey, New York, N. Y. App. filed Oct. 16, 1917. Connected to and disconnected from telephone circuit by operator.

(Issued Feb. 28, 1922)

15,297 (reissue). ELECTROLYTIC APPARATUS; Henri Tobler, Hackensack, N. J. App. filed Dec. 30, 1921. For producing bromine from natural brine.

1,407,692. HEATING UNIT FOR ELECTRICALLY HEATED TOOLS; Frank Kuhn, Lawrence Thomas and Jules G. Spiess, Detroit, Mich. App. filed May 27, 1920.

1,407,693. INSULATION-TESTING DEVICE; John A. Heany, New Haven, Conn. App. filed Dec. 6, 1918. Tests continuity of insulating sheath on wire as fast as made.

1,407,722. ELECTRIC SOLDERING IRON; William A. Braun, Dover, Ohio. App. filed Oct. 22, 1919. Means for two different heats.

1,407,726. THERMOPHONE AND METHOD OF MAKING IT; Theodore C. Browne, Belmont, Mass. App. filed April 26, 1920. Use carbon for the conductors.

1,407,761. ELECTRIC-ARC-STRIKING MECHANISM; Clarence M. Langfeld, Baltimore, Md. App. filed May 13, 1919. Operates automatically.

1,407,794. METHOD OF MANUFACTURING ONE-PIECE RUSTLESS KNIVES FOR TABLE USE; Robert T. Lee, Northampton, Mass. App. filed Oct. 16, 1919. Steel blade welded to non-ferrous handle.

1,407,804. MEANS FOR OPERATING ELECTROMAGNETIC RECIPROCATING TOOLS WITH PULSATING DIRECT CURRENT; Henry Poth, Cincinnati, Ohio. App. filed July 25, 1919. Special tool and generator.

1,407,887. TESTING MACHINE FOR DIELECTRIC OBJECTS; Ernest A. Pigeon, Akron, Ohio. App. filed Dec. 13, 1920. Battery jars tested with metal mandrel.

1,407,892. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed Oct. 14, 1914. Applied to associate multiple.

1,407,900. APPARATUS FOR ELECTRIC WELDING; Richard Stresau, Wauwatosa, Wis. App. filed July 17, 1920. Current regulated by solenoid around movable electrode.

1,407,918. ELECTRIC HEATING ELEMENT; Pierre J. H. Bernard, Montreal, Quebec, Canada. App. filed Dec. 9, 1920. For room heater.

1,407,937. REVOLVING CONNECTOR FOR ELECTRIC CURLING IRONS; Maurice F. Fitzgerald, Torrington, Conn. App. filed June 25, 1920.

1,407,953. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed May 6, 1918. Automatic starting device for converters.

1,407,958. DIRECT-CURRENT MOTOR AND GENERATOR; Greenwood Stirk and John G. Stirk, Halifax, England. App. filed Sept. 18, 1920. Single-pole, two-way switch for field.

1,407,983. METHOD OF AND MEANS FOR DETERMINING UNBALANCE; Alva B. Clark, Brooklyn, N. Y. App. filed July 10, 1920. Of impedance on communication lines.

1,407,985. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 14, 1917. Automatic machine switching.

1,408,040. REGULATION OF ELECTRICAL APPARATUS; Byron W. St. Clair, Lynn, Mass. App. filed Feb. 13, 1920. Speed control for motor-generator, converters or motors.

1,408,046. TELEPHONE SYSTEM; Horace W. Ulrich, East Orange, N. J. App. filed July 11, 1919. Long lines equipped with amplifiers.

1,408,048. TROLLEY-CONDUCTOR CLAMP; Nils J. A. Wahlberg, Wilkinsburg, Pa. App. filed March 31, 1920. For grooved wire.

1,408,053. HOT-CATHODE APPARATUS; Roy J. Wensley, Edgewood Park, Pa. App. filed Aug. 8, 1919. Double-anode rectifier tube.

1,408,071. ELECTRICAL MEASURING INSTRUMENT; William M. Bradshaw, Wilkinsburg, Pa. App. filed Aug. 7, 1917. Excess-demand meters of induction type.

1,408,118. APPARATUS FOR PRODUCING MODIFIED CURRENTS, ETC.; Friedrich W. Meyer, Milwaukee, Wis. App. filed Feb. 1, 1918. Frequency converter.

1,408,119. ELECTRICAL MEASURING INSTRUMENT; John H. Miller, Wilkinsburg, Pa. App. filed Aug. 11, 1917. Excess power over a predetermined value measured.

1,408,125. TELEPHONE EXCHANGE SYSTEM; George E. Mueller, La Grange, Ill. App. filed Nov. 29, 1920. Automatic machine switching.

1,408,140. DRY BATTERY; Walter B. Schulte, Madison, Wis. App. filed March 13, 1919. Several cells arranged vertically within individual compartments.

1,408,141. ELECTROLYTIC APPARATUS; George O. Seward, Niagara Falls, N. Y. App. filed Oct. 11, 1917. Process for electrodepositing magnesium from salts.

1,408,142. ELECTROLYTIC APPARATUS; George O. Seward, Niagara Falls, N. Y. App. filed Oct. 11, 1917. Process for electrodepositing magnesium from salts.

1,408,158. COLLECTOR LIFTING MECHANISM; Samuel Arnold, 3d, Ben Avon, Pa. App. filed Sept. 22, 1921. For disconnecting crane trolley shoes.

1,408,183. ELECTRIC HEATER FOR OUTDOOR USE; Edward A. Everett, New York, N. Y. App. filed March 13, 1919. For thawing frozen railroad switches, etc.

1,408,196. ELECTRIC HEATER FOR THAWING PIPES; Albert C. Hoffman, Huntington, Ind. App. filed March 5, 1921. Half cylinder to fit pipe.

1,408,211. SYSTEM OF SPEED REGULATION AND CONTROL OF INDUCTION MOTORS; Harry A. Laycock, Schenectady, N. Y. App. filed Aug. 8, 1919. For sugar, paper or rubber mills.

1,408,255. DEMAND METER; Clarence A. Boddie, Pittsburgh, Pa. App. filed Sept. 9, 1916. Logarithmic average-value type.

1,408,268. ELECTRIC APPLIANCE; Hoyt Catlin, Bridgeport, Conn. App. filed March 26, 1920. Terminal block and switch used on grills, etc.

1,408,308. HEATING ELEMENT FOR INCUBATORS; Rowland P. Rhodes, Indianapolis, Ind. App. filed March 5, 1921. Covers entire top area.

1,408,364. MANUFACTURE OF PERBORATES; Johann K. Langhard, Fredriksstad, Norway. App. filed Feb. 6, 1920. By electrolysis of borate solutions.

# Construction News

**Projects, Plans, Bids and Contracts Contemplated or Under Way**

## New England States

SEDGWICK, ME.—A committee has been appointed to confer with the officials of the Bar Harbor & Union River Power & Light Company in regard to extending its service to Sedgwick.

BROOKLINE, MASS.—Electrical and mechanical equipment will be installed in the addition to be erected at the high school, Tappan Street and Welland Road, to cost $550,000. French & Hubbard, 260 South Street, Boston, are engineers.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has filed plans for the erection of a two-story switching plant at Western Avenue and Blackstone Street, to cost $161,000.

MALDEN, MASS.—The Malden & Melrose Gaslight Company has received permission from the Department of Public Utilities to issue $651,700 in stocks, the proceeds to be used for extensions and improvements in its system. The company has tendered an offer to the Council at Wakefield, Mass., for the purchase of its municipal electric plant and gas works for $300,000.

NEW BEDFORD, MASS.—The New Bedford Gas & Edison Light Company has applied to the Department of Public Utilities for permission to issue $1,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

WORCESTER, MASS.—Plans are under way by the Worcester Electric Light Company for doing a large amount of underground conduit work this spring and summer.

HARTFORD, CONN.—The Hartford Electric Light Company has submitted a recommendation to the street commissioners relative to placing its overhead wires in underground conduits, involving an expenditure of $206,000 during the next two years, of which $106,000 would be spent in 1922 and $100,000 in 1923. Samuel Ferguson is president.

## Middle Atlantic States

BUFFALO, N. Y.—The Council is arranging a new street-lighting contract with the Buffalo General Electric Company and plans to extend the use of magnetite lamps in other districts and to replace gas lamps with electric lamps.

HUDSON, N. Y.—The Hudson City Steel Corporation, 233 Broadway, New York, will build a power house in connection with its proposed steel works at Hudson, comprising six one-story buildings, to cost $1,000,000. Dwight P. Robinson & Company, 125 East Forty-sixth Street, New York, are engineers.

ITHACA, N. Y.—The New York State Gas & Electric Corporation has issued $700,000 in bonds, the proceeds to be used for extensions and improvements.

LONG BEACH, N. Y.—A power house will be installed in the hotel to be erected by the Alexandria Hotel Construction Company, to cost about $1,000,000. Severance & Van Alen, 372 Lexington Avenue, New York, are architects.

NEW YORK, N. Y.—The Long Island Lighting Company, 50 Church Street, is arranging a fund of $1,000,000 for extensions and improvements.

NEW YORK, N. Y.—An appropriation has been granted by the Board of Estimate for the installation of a new fire signal system in the Bronx.

NEW YORK, N. Y.—The New York Central Railroad Company will receive bids until March 22 for lead-covered cable and copper wire, etc. W. C. Bower, 466 Lexington Avenue, is purchasing agent.

NEW YORK, N. Y.—Hugh L. Cooper & Company, 101 Park Avenue, consulting engineers, have submitted a proposition to the International Joint Commission, Toronto, Ont., for the construction, by private interests, of a power dam and hydro-electric generating plant on the St. Lawrence River, near Morrisburg, Ont., to cost about $75,000,000, including transmission system. Other plants are to be constructed later to provide an aggregate of 400,000 hp.

OLEAN, N. Y.—A power house will be built by the Vacuum Oil Company, 61 Broadway, New York, in connection with extensions to its local oil plant, to cost about $1,000,000.

BLOOMFIELD, N. J.—A power house, 65 ft. x 165 ft., will be constructed by the Clark Thread Company, 260 Ogden Street, Newark, N. J., at its new bleaching plant to be erected at Bloomfield, to cost about $200,000. The equipment will include two 500-hp. boilers and a 500-kw. generator, with auxiliary equipment.

LIVINGSTON, N. J.—The Morris & Somerset Electric Company, Morristown, has been granted a franchise to install a street-lighting system in Livingston.

PATERSON, N. J.—A power house will be installed in the factory to be erected by the Paterson Industrial Development Company, 5 Colt Street, to cost about $400,000.

STOCKTON, N. J.—The Eureka Power Company, Yardley, Pa., has applied for a franchise in Stockton. The transmission system will be extended from Lawrenceville, N. J. It is expected to extend the lines to Rosement, Sergeantsville and vicinity.

ALLENTOWN, PA.—Officials of the Pennsylvania Power & Light Company have organized subsidiary electric companies to operate at Miners' Mills and Plains and have filed application for state charters.

HARRIMAN, PA.—The Eastern Pennsylvania Gas & Electric Company, Bristol, Pa., is considering extending its system to Harriman.

LEHMAN, PA.—The Lehman Electric Company, recently organized, is planning extending its lines to a number of towns in this section.

PHILADELPHIA, PA.—Martin H. Walrath & Son, Park and Glenwood Avenues, will build a power house at their new woodworking plant to be erected on Indiana Avenue.

PHILADELPHIA, PA.—Power equipment, motors, etc., will be installed in the first unit of the four-story mechanical building to be erected by the Public Ledger Company, Independence Square, at Seventh and Sansom Streets, to cost about $2,000,000, with equipment.

PHILADELPHIA, PA.—An electric power plant will be constructed by Albert M. Greenfield & Company, Fifteenth and Chestnut Streets, on property acquired at Fifteenth and Ionic Streets, in connection with an eighteen-story office building to be erected on an adjoining site. The complete project will cost $4,000,000.

PHILADELPHIA, PA.—The Bureau of Yards and Docks, Washington, D. C., Navy Department, has awarded a general contract to the Herman Mayer Company, Inc., 105 Walnut Street, for extensions and improvements in the power plant at the local navy yard, to cost $238,889.

BALTIMORE, MD.—The J. L. Gilbert & Brother Lumber Company, Eastern and East Falls Avenue, will erect a power house at its new plant in the Union Stock Yard district. A site of 9 acres has been acquired.

BALTIMORE, MD.—The Board of Awards, care of Richard Gwinn, city register, City Hall, will receive bids until March 22 for 300,000 ft. of six-way, multiple vitrified conduit. Charles F. Goob, City Hall Annex No. 1, is chief electrical engineer for the commission.

HAGERSTOWN, MD.—The Council is considering the erection of a new municipal electric plant to replace the present station, for which bonds were voted several months ago.

SPENCER, W. VA.—The Council plans the construction of an electrically operated pumping plant, in connection with new sewage-treatment works. C. E. Collins, Drexel Building, Philadelphia, Pa., is engineer.

ATHENS, W. VA.—The Council is preparing plans for the erection of an electrically operated pumping plant in connection with a new waterworks system. C. E. Collins, Drexel Building, Philadelphia, Pa., is engineer.

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, will receive bids until March 28 for 100 battery-charging panels for the Washington and Puget Sound Navy Yards (Schedule 9505); also for 60,000 lb. of grain magnesite for lining and relining of electric furnaces at the Philadelphia Navy Yard (Schedule 9503).

WASHINGTON, D. C.—The office of the chief signal officer, United States Army, will receive bids until March 21 for 300 cranks for generators, 120 folding cranks for generators and 105 generators. (Proposal 10017-28 CP.)

## North Central States

DETROIT, MICH.—The Detroit Sand Lime Brick Company, 507 Vinton Building, will build a power house in connection with its new plant at River Rouge, for which bids will soon be asked.

PONTIAC, MICH.—A power house will be erected by the Corodium Sand Lime Brick Company, recently organized, at its new local plant.

DAYTON, OHIO—Motors and other electrical equipment will be installed in the new baking plant to be erected by the Holland Bread Company, Toledo, Ohio, on South Ludlow Street, to cost about $225,000. A. E. Craig is manager.

OTTAWA, OHIO.—The installation of a municipal electric-lighting plant in Ottawa is under consideration.

TIPPECANOE, OHIO.—An election will soon be called to submit to the voters the proposal to issue $60,000 in bonds for rebuilding and enlarging the municipal electric light plant and water works.

VAN WERT, OHIO—An electrically operated pumping plant will be installed at the proposed sewage-disposal plant and sanitary sewerage system, for which plans are being drawn.

LEACH, KY.—A power plant will be constructed by the Great Eastern Refining Company in connection with its new local oil refinery, to cost about $250,000.

EAST CHICAGO, IND.—The installation of a street-lighting system on Forsythe Avenue is under consideration by the Board of Public Works.

INDIANAPOLIS, IND.—Bids will be received by the Board of Sanitary Commissioners, Sanitary District of Indianapolis, City Hall, until March 30 as follows: (a) Three 400-hp.-each water-tube boilers, equipped with super heaters, soot blowers and appurtenances; (b) three chain-grate stokers with accessories; (c) three steam turbine blowers, 16,000 cu.ft. per minute capacity each; (d) two steam turbine-driven generators, 500 kw. each, including separate excitation units; (e) five surface condensers, approximately 750 sq.ft. cooling surface each, complete with air and condensate pumps; (f) one switchboard of six or more panels, with instruments; (g) mechanical equipment for sludge removal for concentrate thickener tanks; (h) mechanically operated weir gates and weir control for fine screen clarifiers; (i) four drilled wells, 12 in. diameter and approximately 88 ft. deep, fully cased and equipped with well screens as provided. Charles H. Hurd, 1403 Merchants' Bank Building, Indianapolis, is consulting engineer. Jay A. Craven is president of board.

LAFAYETTE, IND.—The Northern Indiana Gas & Electric Company has tendered a proposal to the receiver for the property of the Lafayette Public Service Company. Permission has also been asked of the Public Service Commission.

MATTESON, ILL.—A power house will be erected by the Mid-West Box Company, 111 West Washington Street, Chicago, in connection with its new local plant, to cost about $300,000. K. I. Herman is in charge.

PEORIA, ILL.—Preliminary plans are under way for the erection of a new power house in Peoria for the Illinois Traction System, to cost about $500,000.

MADISON, WIS.—Plans are being prepared by the Wisconsin River Power Company for the erection of a 33,000-volt transmission line from Dane to the Beaver Dam, 35 miles long, and also an outside substation at Columbus.

MILWAUKEE, WIS.—The American Hide & Leather Company, Fourteenth Street, is completing plans for the erection of a one-story power house, in connection with the rebuilding of its local tannery, comprising four buildings, to cost about $600,000. Lockwood, Greene & Company, 38 South Dearborn Street, Chicago, are architects and engineers.

CLARKFIELD, MINN.—The Council is having plans prepared for an electric distributing system. C. L. Pillsbury, 1200 Second Avenue, Minneapolis, Minn., is engineer.

GRANITE FALLS, MINN.—The Council is considering plans for extensions and improvements in the municipal electric system.

DAVENPORT, IOWA—The Tri-City Railway & Light Company has arranged for a bond issue, part of the proceeds to be used for extensions and improvements. Frank T. Hulswit is vice-president.

EAGLE GROVE, IOWA.—The Council is arranging for a special election to vote bonds for the erection of a municipal light and power plant.

COLUMBIA, MO.—The Board of Trustees, University of Missouri, has awarded a general contract to Collins Brothers, 536 Rialto Building, Kansas City, Mo., for the erection of a power house, to cost $150,000.

JEFFERSON CITY, MO.—The Jefferson City Light, Heat & Power Company contemplates extensions and improvements in its electric system to cost about $75,000, including the installation of new boilers, stokers and extension of transmission line.

KENNETT, MO.—The Caruthersville & Kennett Light & Power Company is planning for extensions and improvements in its plant and transmission system to cost about $100,000. The lines will be extended to Rector, Ark., and vicinity.

ST. CHARLES, MO.—A special election will be held on March 25 to vote on a bond issue of $250,000 for municipal improvements, of which $175,000 will be used for the construction of a municipal light and power plant.

DEVILS LAKE, N. D.—The Midwest Power Company has tentative plans under way for the construction of an addition to its power plant, including the installation of new machinery. R. W. Dyson is manager.

WOOD LAKE, NEB.—Bonds to the amount of $29,700 have been voted for the construction of a municipal electric light plant and waterworks system. The town has been without electric service since the plant of the Wood Lake Electric Light & Power Company was burned down about six weeks ago.

PARSONS, KAN.—Bids will be received by the City Commissioners until March 28 for pumping machinery, electrical equipment, etc., for waterworks system, including a 3,000,000-gal. crank and flywheel opposed-type pumping engine; 1,000 gal. and 1,800-gal. motor-driven centrifugal pumps and electrical equipment for the Neosho River pumping station; 1,400 gal. and 2,100-gal. motor-driven centrifugal pumps; two 180-kva. engine-driven generators; two 150-hp. water-tube boilers, with accessories and electrical equipment. Burns & McDonnell, 402 Interstate Building, Kansas City, Mo., are consulting engineers. F. W. Frye is city clerk.

WICHITA, KAN.—The Kansas Gas & Electric Company has arranged for a bond issue of $8,000,000, a portion of the proceeds to be used for extensions and improvements to its system. F. G. Sykes is vice-president.

## Southern States

GREENVILLE, N. C.—The Board of Water and Light Commissioners has plans in progress for the installation of a new street-lighting system. E. E. Williams is superintendent.

RALEIGH, N. C.—The Carolina Power Company, recently organized by officials of the Carolina Power & Light Company as a subsidiary, has plans under way for the erection of a power dam, 1,000 ft. long and about 100 ft. high, on the Pee Dee River, near Babin, N. C., and hydro-electric power plant, with maximum capacity of 35,000 hp. The cost of the project is estimated at 2,000,000 and will include a transmission line to connect with the present 100,000-volt system of the parent organization. Charles E. Johnson is president of both companies.

WENDELL, N. C.—The North State Power Company is planning for the rebuilding of the portion of its power plant destroyed by fire March 5, with loss estimated at about $25,000.

SUMMERVILLE, GA.—The Summerville Cotton Mills are planning for the erection of a hydro-electric power plant on the Chattanooga River for mill and general commercial service. John D. Taylor is president of the cotton mills.

WEST POINT, GA.—The West Point Manufacturing Company is considering the construction of a hydro-electric power plant on the Chattahoochee River, near the site of its present station.

FERNANDINA, FLA.—A special election will be held April 4 to vote on a bond issue of $37,000 for extensions to the municipal electric plant, ice plant and waterworks, of which about $20,000 will be used for the electric plant.

EUPORA, MISS.—The Council has engaged Xavier A. Kramer, Magnolia, engineer, to prepare plans for extensions in the street-lighting system, to cost about $25,000.

CUMBERLAND, TENN.—The Cumberland Power Company has closed a contract with the Tennessee Power Company, Parksville, for power supply, and will build a transmission line about 50 miles long to connect with the Tennessee system. A local substation will be constructed. The entire work is estimated to cost about $125,000. G. S. Nunamaker is vice-president. Cumberland has not a postoffice.

BEEVILLE, TEX.—The Beeville Electric & Ice Company contemplates the construction of an addition to its power plant, to cost about $30,000.

HUGO, TEX.—The Hugo Ice & Light Company is planning to erect a transmission line, about 17 miles, to the Fort Towson section, to cost about $32,000. J. C. Meadors, 1302 Southwestern Life Building, Dallas, Tex., is engineer.

DALLAS, TEX.—Improvements contemplated by the Dallas Power & Light Company include the erection of a cable from the main power plant up Trinity River to Commerce Street to the Jackson Street station, to cost $53,000; installation of a motor-generator set in the East Dallas power station, $41,500, and the erection of an electric transmission line to Trinity Heights to connect with the line of the Texas Power & Light Company.

## Pacific and Mountain States

PORT MOODY, WASH.—The Thurston & Flavelle Company contemplates the construction of a power plant and the installation of motors and other electrical equipment in the various departments of its lumber mill, to cost about $60,000. Port Moody has not a postoffice.

BETZEN, ORE.—The Monroe Shingle Company is planning to rebuild at once its shingle mill, destroyed by fire last year. The plans include a power plant and equipping the entire plant with electrically driven machinery. The cost is estimated at about $100,000. Betzen has not a postoffice.

FAIR OAKS, CAL.—The Carmichael Irrigation District has rejected all bids submitted for electrically operated pumping machinery for its irrigation system. New bids, it is understood, will be asked for at an early date.

MODESTO, CAL.—The directors of the Modesto Irrigation District have authorized C. A. Hilton, president, to execute contracts with the Sierra & San Francisco Power Company for a right-of-way for an electric transmission line to the drainage pumping stations to be installed by the district.

RICHMOND, CAL.—The Galena Signal Oil Company, Franklin, Pa., will build a power house in connection with its new oil refinery, to cost about $500,000. Charles A. Miller, superintendent of the Franklin refinery, is in charge.

SAN BERNARDINA, CAL.—The Santa Fe Railroad Company, Kerckhoff Building, Los Angeles, will build a power plant at its shops, to cost in excess of $75,000.

SAN LEANDRO, CAL.—The Council is planning for the extension of the ornamental street-lighting system on Estudillo Avenue. R. W. Goodwin is the city engineer.

TAFT, CAL.—The City Trustees are planning for the installation of an ornamental street-lighting system on North Fourth, North Fifth and Center Streets. E. M. Lynch is city engineer.

VENICE, CAL.—Extensive improvements are contemplated by the Southern California Edison Company to its local system, including the erection of a new substation and extension of transmission lines running out of Culver City to the other bay district cities. The program calls for an expenditure of $383,000 in the Santa Monica Bay district.

## Canada

BRANDON, MAN.—The City Council and the Brandon Board of Trade have petitioned the Manitoba Legislature to make an appropriation at the present session for the extension of the hydro-electric lines to Brandon.

CAMPBELLTON, N. B.—The Town Council is considering placing all electric light and power wires underground.

FORT WILLIAM, ONT.—Arrangements have been made whereby the Hydro-Electric Commission will supply electricity from the Nipigon plant to the Consolidated Elevator in Fort William. The contract calls for the delivery of between 500 hp. and 600 hp.

KOMOKA, ONT.—The installation of an electric light and power distribution system at Komoka, to cost about $33,000, is under consideration. A. Purcell, 190 University Avenue, Toronto, is engineer.